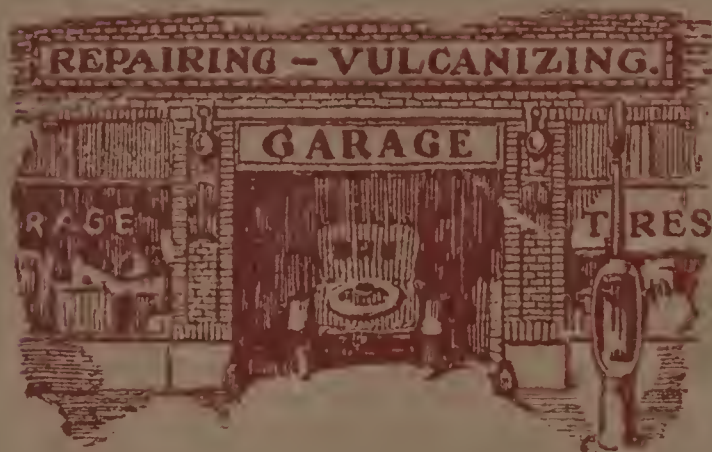


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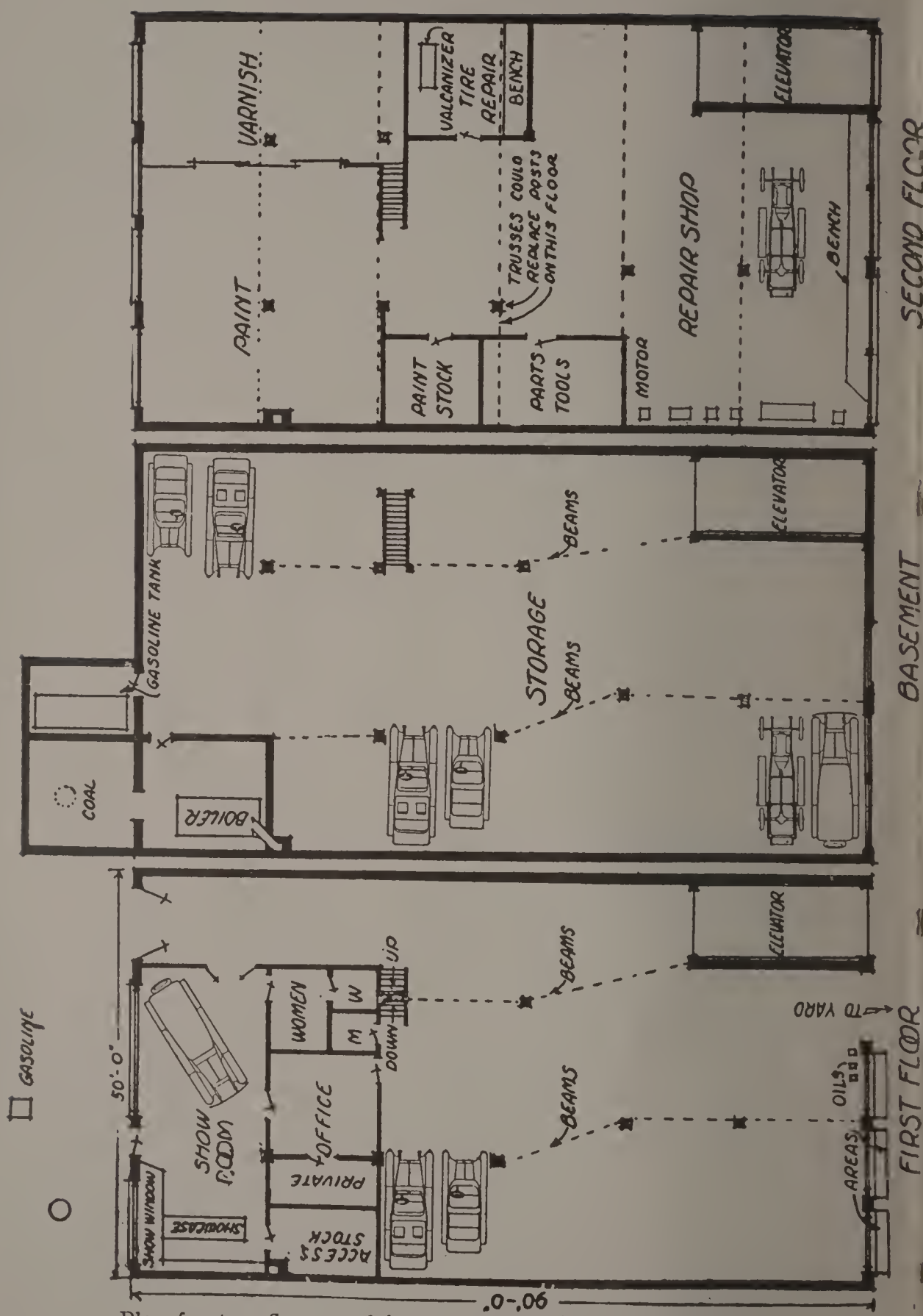
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INCREASING YOUR PROFITS



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Plan for two floors and basement, covering all branches of the garage business.

American Automobile Service Digest

INCREASING YOUR PROFITS



*A Manual of Instruction for
the Proprietor of a Garage,
Repair Shop, or Service Sta-
tion that Points the Way to
Greater Profits* *SS SS SS*



COMPILED BY THE
EDITORIAL STAFF
OF THE
AMERICAN AUTOMOBILE DIGEST

57 Illustrations

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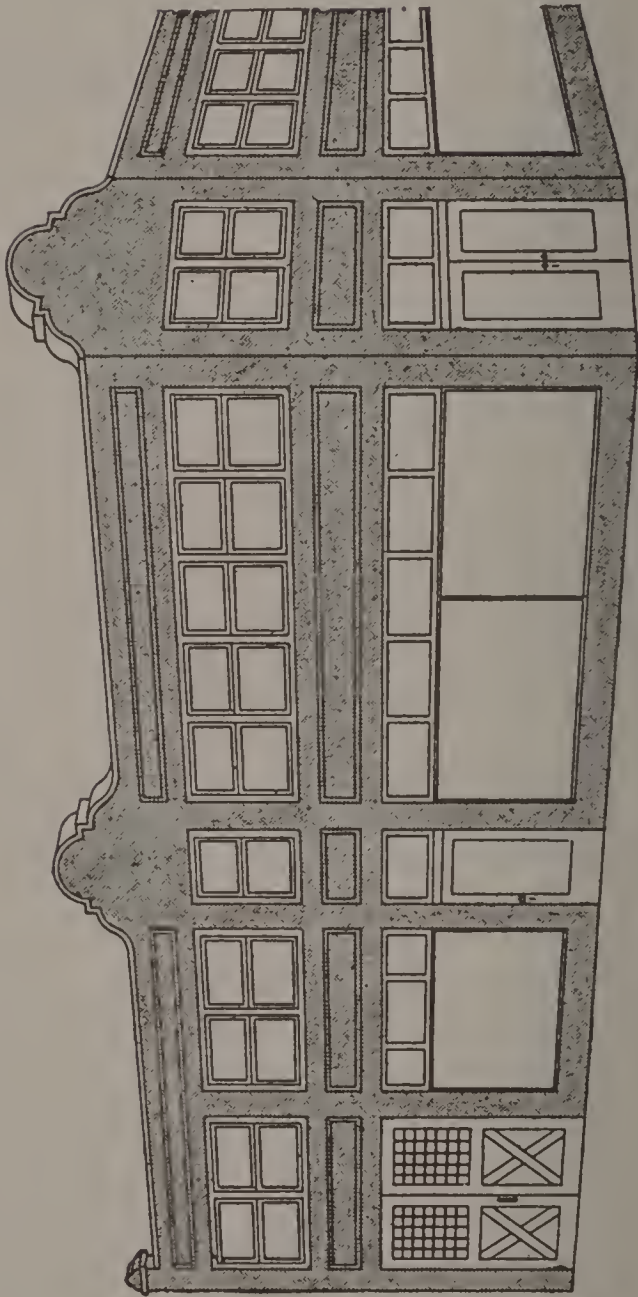
INCREASING YOUR PROFITS

THE MODERN GARAGE

Its Various Branches, Constructions of Floors, Walls and Roof—Floor Plans for Various Combinations—Some Factors Which Tend to Promote Success

BEFORE entering into a discussion of the modern garage, let us analyze the term “garage” and the garage business, together with its requirements. The term “garage” came to us from France in the early days of automobile history. Its adoption being favored by the lack of a suitable English name for an automobile repository. Garage originally meant round-house, and is therefore borrowed from railway terminology, the same as the term “chauffeur.” In the rural districts it is still common to use the compound “automobile garage,” but as the term is now so generally understood it is perfectly safe to drop “automobile.” The word “garage” has become an integral part of the English language, though opinions as to its proper pronunciation are still at variance.

There are two general schemes commonly followed, that of having a car agency and a garage, or the handling of accessories and doing a general



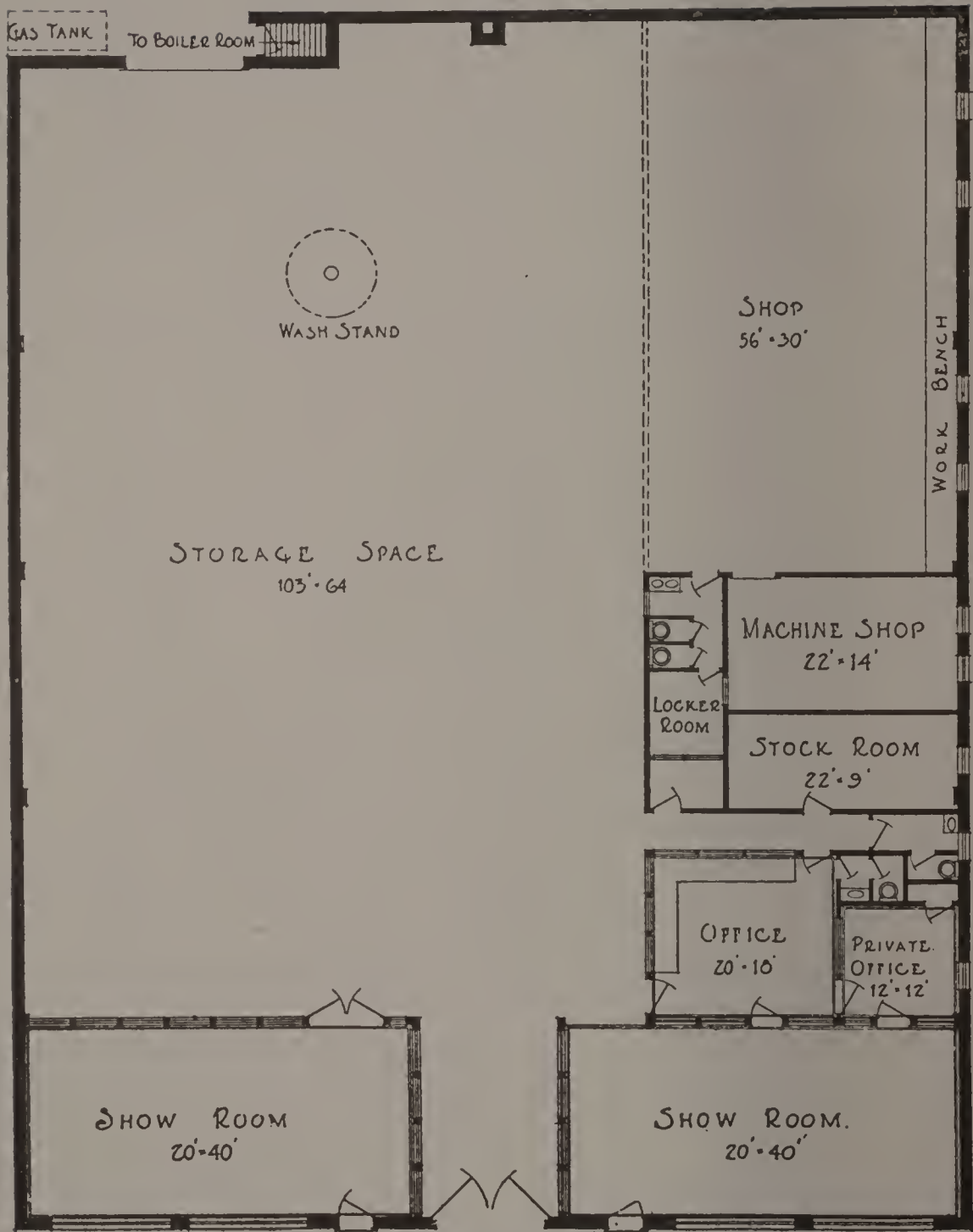
Perspective of a two-story garage and car agency.

garage and repair business. The garage business, if the term is used in its broadest sense, includes quite a number of branches. The relative importance of these will, of course, vary with the location of the garage, and not every garage is so located as to profitably cater to all lines. The lines may be enumerated as follows, in order of their importance:

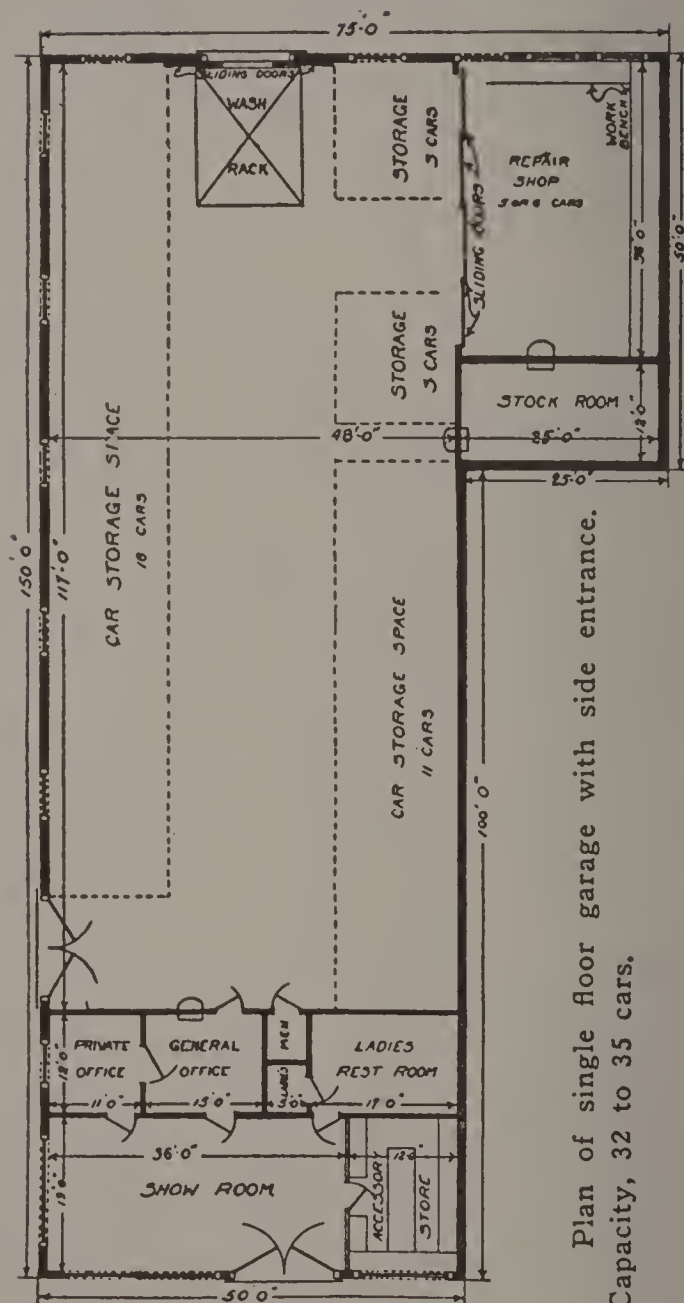
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| 1. Storing vehicles. | 4. Sale of accessories. |
| 2. Sale of supplies. | 5. Sale of cars. |
| 3. Repairs. | 6. Livery service. |

The first is no doubt the basic branch of the garage business, although it is mostly developed in the large cities where many people of financial means live in congested districts and have no facilities for housing their cars on their premises. In such cases the scope of the business is most generally limited. As a general rule the large city garage confines itself to the storage of vehicles, sale of supplies and repair work, and many even eliminate the repair work. In such cities accessory and supply stores, machine and repair shops are numerous, and since a large field is available, it pays to specialize. As a general rule car agencies are not maintained, for the reason that display rooms must be located on the main commercial thoroughfares, where rents and other expenses are high. For this reason garages are located on side streets, thus reducing expense considerably, for in these days of high finance rent is quite an item.

In the rural districts, small towns, and particularly in the newer parts of the country, the stor-



age business is of much less importance, owing to the fact that the majority of owners keep their cars on their premises. There is, however, quite a revenue to be obtained by providing for those who have no storage space. In such towns, however, there are no automobile supply stores and few, if any, machine or repair shops, while the sale of gasoline, oil, grease, etc., forms a considerable source of revenue. Another factor is that the market for cars in small towns hardly justifies the establishment of special sales rooms and the undivided attention of a manager and clerical force. Another factor is that car manufacturers prefer agencies equipped to give service to customers. Thus the country garage is generally an agency also. From our analysis we can appreciate that the garage business in the smaller cities usually covers at least five activities, viz., storage of cars, sale of accessories, sale of supplies, car sales, and car repairs. The nature of the business and financial ability of the owners will govern its location, since an agency would naturally be placed to best advantage in any locality, while for a general business a somewhat central location may be selected. In either, ample provision should be made for display space, and this naturally suggests a place occupying the forward portion of a plot of ground. The rental value must not be omitted in considering locations. While a corner bay be desirable from a retail point of view and is no doubt of considerable advantage if the business warrants, yet it is possible to be equally as successful by selecting a building in the center of a block and providing attractive



Plan of single floor garage with side entrance.
Capacity, 32 to 35 cars.

displays. In many lines of business the corner is considered essential, and it cannot be denied that it has its advantages in the garage business.

One of the essentials of our career, whether it is a business, professional or manufacturing, is the foundation. In the business, manufacturing or professional career, it is the training one has received; in the garage it is the foundation for that business. Therefore, much of the success of any business can be directly attributed to the building in which it is housed, and its lo-

Building Construction

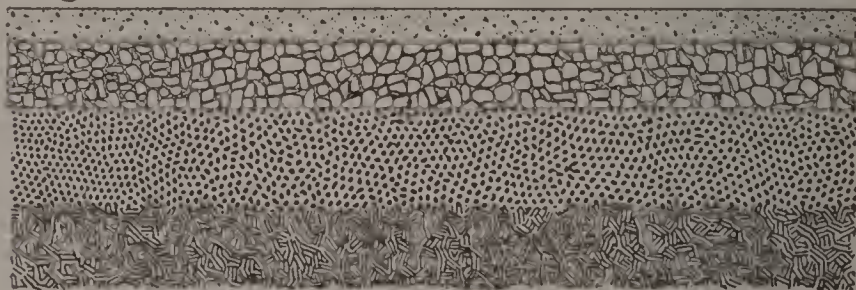
If real estate values permit, the single-floor garage has many advantages. That is, a garage in which all cars or tire storage are accommodated on the ground floor. For storing cars on upper floors or in basements, elevators or runways must be provided, either of which is an item of considerable expense. The most practical plan, where it is desired to have two floors, is to place one somewhat below the ground and the other somewhat above, thus permitting two inclined driveways, one to each floor. Occasionally the ground slopes enough to provide an entrance at one point to one floor and another entrance at some other point which is considerably lower. As a general rule it will be found of advantage to limit the garage to the one-floor plan, but there are some departments which can be conveniently placed on the upper floor. The second floor may be arranged to accommodate the office, stock-rooms, and perhaps the machine shop and tire repair shop.

Construction of Walls

The side walls can be made of different materials, such as brick, reinforced concrete or concrete blocks, while terra cotta field stone and stucco stiffened by wire cloth may also be used. The relative costs of the various materials and methods of construction varies in the different localities, and local conditions therefore determine their respective advantages. The wall construction of garages does not differ from that of any other structure for commercial purposes, the problem being one mainly of floor and roof construction.

Construction of Floor

The floors of single-floor garages can be laid directly on the ground, since cement floors are almost universally used. In constructing these



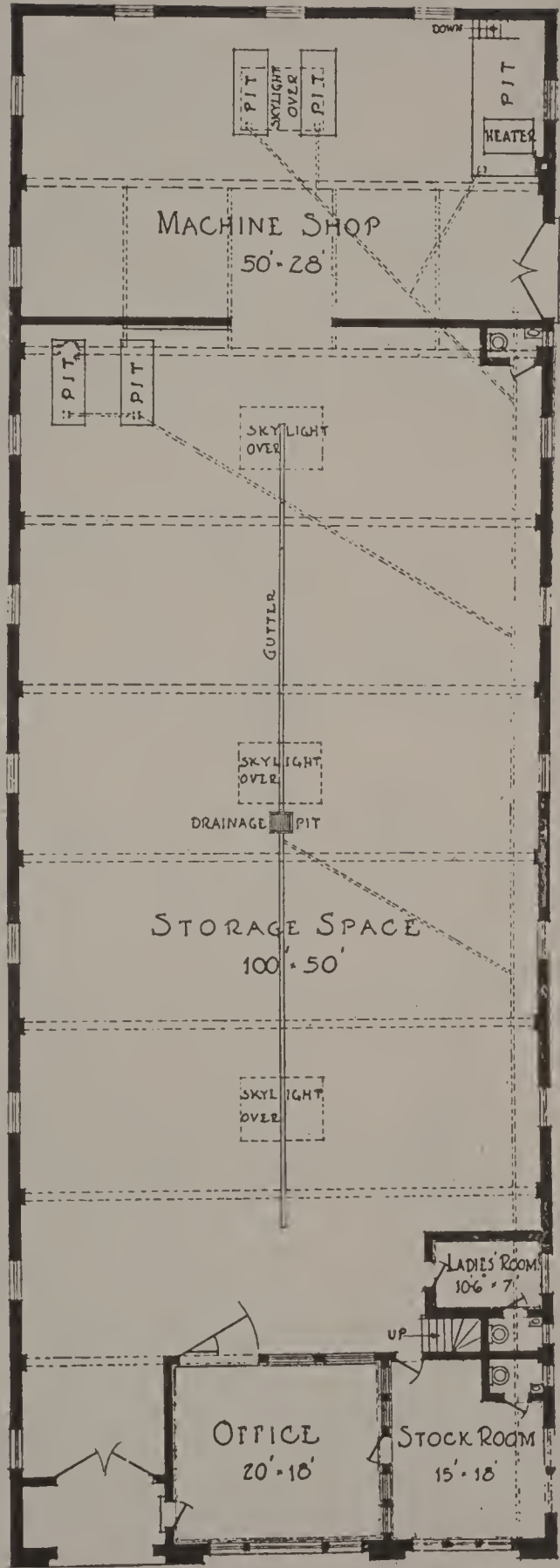
Construction of cement ground floor.

floors some excavating is necessary, since a layer of cinders is placed, over which a layer of concrete and finally a layer of cement and sand are added. The floor arrangement, of course, should provide facilities for the various jobs, such as wash-racks, drain pipes, etc. For upper floors

the reinforced concrete construction is usually employed, although the semi-fireproof type, consisting of wood may also be used.

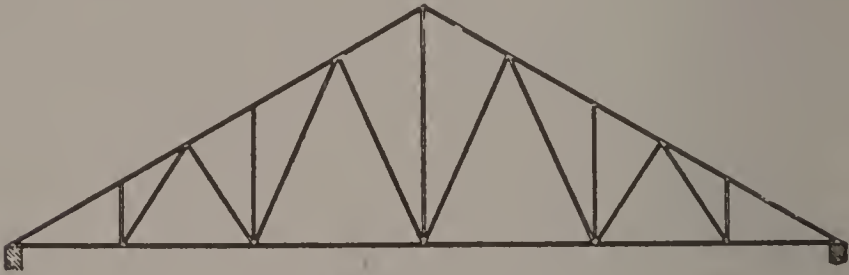
Construction of Roof

For a building 50 feet wide a trussed roof can usually be used, which may be made of either wood or steel. This will allow cars to be stored in two rows against the side walls and provide ample space for a driveway between the rows. Length then becomes the limiting factor as regards capacity. Several illustrations are shown here-with covering both the wood or steel trussed roof.



Plan of a single floor suburban garage for tire storage and repair business.

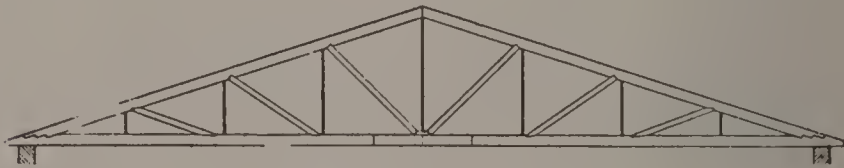
Probably no other conditions contribute more toward securing the largest amount of success in the garage business than a properly arranged building, good order of stock and equipment, and all-around cleanliness. These factors should receive the proper consideration from garage owners, as they furnish real problems and ought



Steel Roof Truss.

to be properly solved. A properly arranged building will go a long way toward handling the business in an economical and efficient way.

In the train of unprogressive thought which is speeding on to mediocre success and even failure, are many garagemen and automobile dealers, who



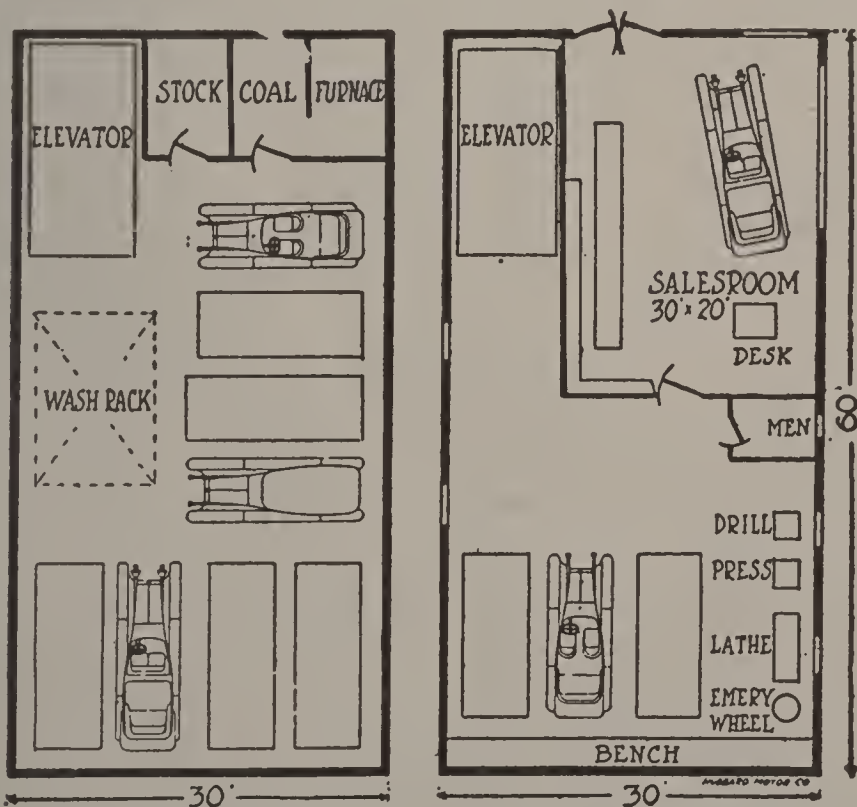
Wood Roof Truss.

have mistaken notions—especially those in the smaller towns and agricultural sections—concerning the advantages of proper displays and building arrangement. It is not necessary to rebuild, but if a new building is to be built, build it strong. If you have an old building, doll it

up, for you will be surprised to learn that a few dollars' worth of lumber and good paint will work wonders. Do not hesitate to provide the proper illuminating effects for both storage and display spaces, for proper illumination is a wonderful advertisement. This, combined with cleanliness, will make very a favorable impression upon anyone entering your establishment.

Floor Plans

The floor arrangement will depend upon the dimensions of the available site, whether the building faces one or more streets or alleys, the nature of the business to be catered to, etc., as each case will require special study. Usually



Plan of small suburban garage consisting of one floor and basement.

in planning a new building a number of plans can be obtained from the architect which will be of valuable assistance in working out the floor arrangement.

Little can be said about very small garages, as they are usually nothing more than supply stations, doing minor repair work, tire repairing, and carrying accessories and supplies. Generally the whole building consists of a single room, with perhaps a corner railed off for a desk and showcase. For repair work, a lathe, drill press and forge may be placed in another corner. Illustrations of several different combinations are shown herewith, covering different sizes. They are not intended as rigid plans to be followed in the erection of garage buildings, but to suggest the advantages of various floor plans under different conditions. The area occupied by each car depends to a very great extent upon the class of business a garage is doing. On an average, large passenger cars require a space 18 feet long by 7 feet wide, or a floor area of 126 square feet per car, while the smallest cars can be stored in a space 13 feet long by 7 feet wide, which gives an area of 91 square feet per car. Thus it is evident that four small cars can be stored in the space required for three large cars.

In addition to the space actually required by the cars, room must be given up for driveways to the storage spaces. The area of these driveways will be determined, of course, to a considerable extent by the floor plan of the building and the size of the cars stored. In attempting to estimate the floor area required, one must give ample con-

sideration to all the various departments that will be required. The amount of supervision required must also be considered, so that the minimum amount of energy is wasted and at the same time customers receive the maximum in service.

See frontispiece for diagram showing plan for two floors and basement, covering all branches of the garage business.

Some Factors Which Tend to Promote Success

There are certain principles which apply to each individual business; however, there are others which can be applied to any business. Perhaps the most lacking of these is cleanliness. A garage should always be kept spick and span. It should be cleaned daily, and one employe should be appointed to do this cleaning. There is not the slightest excuse for any dirt anywhere. Window sills, ledges and walls are prone to be catch-alls for many articles, worthless and otherwise. Nothing should be permitted to be placed upon them at any time. Special receptacles should be provided for junk, old wiping cloths, paper, etc. Under no circumstance should these be permitted to accumulate under the work benches. Such articles should be placed in the proper receptacles and removed at least once daily.

Buyers of automobiles, supplies and service, especially women buyers, certainly dislike going into a place where it is necessary for them to step over a bump or puddle of grease or oil, and

where they cannot occupy a seat or touch anything because of grease and dirt. They will transfer their business to an up-to-date, clean business place.

Good order of stock and equipment is also an important matter. Proper provision should be made to keep supplies and accessories in their proper place. Accessories should never be displayed in the car display room, for they will distract from the appearance of the car. Some other provision should be made for displaying accessories. Never permit a large number of miscellaneous signs to be shown in display rooms or windows, or even the walls of the garage; place a few of them and then alternate with others. Study your advertising matter and displays and make them attract attention, and thereby create a desire for them by the motoring public.

No less important is your organization of employees; they should be taught cleanliness and to be courteous to all. Never permit them to accept additional remuneration for little odd turns of assistance. Pay them a living wage and employ only men who are skilled in the work they are to perform. The motorist who would trust his car to your care is entitled to and should get the same sort of treatment that he receives when purchasing a new car, jewelry or any commodity.

Remember that the first impression made upon a prospective customer is lasting. Have your force trained to render service immediately and send him away with the impression that your garage is a regular place.

Systemize your business and advertise the fact that you have a first-class garage and that you are doing business on the cost plus reasonable profit plan. Work out a business policy and stick to it. Any business can be made a success by careful study and analysis of the conditions surrounding it.

HOW TO CONDUCT A GARAGE SUCCESSFULLY IN A SMALL TOWN

Its Location, Problems and How to Make It Pay

WHAT are the principles whereby the small town garage operator can best succeed? This question often is asked and there seem to be almost as many answers as there are successful garagemen in these small places.

Often a garage operator in a small town becomes more prosperous than an operator starting with more capital in a large city. While the city garage owner has the opportunity of building up a large community trade, he does not always obtain the heavy tourist trade that falls to the lot of the small town garageman who has an especially favorable location.

That is the most important step in starting a garage business in a small center—pick out a good location. If possible have it—

(a) On or near the public square in the center of the town.

(b) On a highway of national, state, or county importance.

And the newcomer should not be afraid of getting too close to an already established garage. A group of garages, like a group of department stores, creates an actual center of trade. People get in the habit of coming to it, and no one place ever gets all the trade unless the rest are "dead ones."

Having selected your site, have you decided what sort of a garage you are going to run?

Usually the word "garage" means much more in a small town than it does in a large place, for in the former it frequently includes dealer and distributor of one or more makes of automobiles, automobile supply house and general storage place.

Are there enough car owners in the probable range of your operations to make it profitable to you to devote much space to storage of cars, or would it be a more paying policy to use that floor space for agency, stockroom, or repair shop purposes?

Are you going to include trucks and trailers in your storage proposition, or is it going to be for automobiles alone? Usually the garage operator in a small place includes everything in the way of a motor vehicle, or its auxiliary, that he can, at any rate when he is beginning,

And when he gets to the point of having his garage built, or moving into one he has purchased or leased, it is well for him to have on his sign and in his advertising that he stores both automobiles and trucks, perhaps giving many a commercial man and farmer a tip for which they long have been looking.

This article will not be concerned with whether the garage operator has built, or purchased ready-made; merely discussing how he may conduct his garage and what he will need with which to do it successfully.

Having decided, let us say, to store all kinds of motor vehicles and auxiliaries, such as trailers or semi-trailers, many of which now are in use in small centers and on farms, how about the type of storage service given?

That is, shall the storage be on the "live," "live" and "dead," or "semi-live" plan, or a combination thereof?

In garage parlance, "live" storage usually means taking care of an owner's car in a thorough manner, washing it nightly and seeing to it that the car is clean and ready for removal in the morning.

"Dead" storage usually signifies simply allowing a car to remain in the shelter of the garage "as is," or without particular care, or washing.

"Semi-live" storage, a comparatively new development, means for instance, keeping a car clean on the inside; brushing it off on the outside nightly and washing it once a week.

Garagemen ordinarily make three separate charges for these accommodations.. Some assert they make more money out of the "semi-live" storage plan, though the rate charged is a little less than that for "live" storage. "Semi-live" storage should be especially suitable to a clientele in a small town, or for the rural trade, as these owners usually do not care to have their cars washed or shined up daily. The car that is

washed three or four times a week, or nightly, is considerable of an expense to the garageman, because of the high cost of labor—washers are paid big wages nowadays—and of materials for cleaning cars. If high-grade materials are used in cleaning a car on the “semi-live,” or plan requiring less labor, the machine will appear well enough for all ordinary purposes and prove more economical in the end for both customer and garageman.

It is well to have the washing stand equipped with a hose suspended from a swing-arm on a swivel fastened to a beam in the roof, as this permits the hose to be swung in any direction and keeps it off the floor.

For cleaning and repair purposes most modern garages have a deep pit in the floor, covered when the car is not in work at that point, so the workman can have easy access to the car's under part. Where there is no pit, often a “home-made” trestle, about three or four feet high is used to run the car up on to make the under portion readily accessible. Either of these plans is better than the laborious process of raising the car by chain hoist.

Some garages have a rule that no car is to be washed while hot, as this tends to remove the lustre from the hood and radiator. Often a garage will have a laundry stove for supplying hot water all the year around.

Where there are pillars, or supports running through the garage, it is convenient to have the water piped down the posts, with faucets a few feet from the bottom, within easy reach. This

will obviate having to move cars around much, and if heavy trucks are stored, this plan will greatly facilitate washing them without their having to be moved.

Sometimes garagemen number all allotted spaces for cars, hanging up a large pasteboard or metal sign with the number over each space. Then the customer, who has been assigned a number for his garage space, knows exactly where to find it. Often garagemen have a rule to arrange cars forward in the order in which they are to be removed in the morning, taking care to keep the aisles between the rows of cars free at all times.

Oil and air should be kept as far front as possible, so in winter a customer will not have to be kept waiting any longer than necessary. The air compressor usually is kept on a beam to prevent vibration and to keep it out of the way of workmen and customers.

Even a small garage in a small town usually finds it pays to have at least one 550-gallon gasoline tank in front, the "gas" to be pumped from the outside. The gasoline is usually buried beneath the sidewalk. Lubricating oil is kept handily in portable tanks. It is good policy to buy at least fifty gallons. One or two gasoline tanks in front of a garage serve as good advertisements of the garage owner's business.

An auto "ambulance" and a good jack are almost indispensable to a well conducted garage. Not only are they valuable in case of accident, but many other daily uses are found for them. For instance, the jack can be used in the nightly

examinations which all the cars in the garage should have. The wheels of each car are raised by means of the jack and the tires are inspected to determine the extent of general wear. Where tires are sold by the garagemen, or vulcanizing done, this examination is a great business-bringer. Advice to the car owner in the morning, on the requirements of the car, and a demonstration, are almost invariably profitable.

Where the garage owner has a night manager, he should require the manager to inspect all parts of each car nightly and leave a report of their condition on the desk for inspection, giving the space number, or owner's name in each instance.

To install and maintain a light repair shop in a small garage is not particularly expensive, and it can be made to pay well if repairs are done in a workmanlike manner and promptly made and an effort is made to get trade by personal solicitation and well-worded circulars or letters sent out periodically to a list of car owners.

For light general repairs, the garage in the small town will require, or should have, the following equipment:

Two or three work benches having drawers that lock, compartments for nuts, bolts and small parts and a vise each.

Small bench tools like wrenches, files, reamers and scrapers.

Portable electric drill.

Chain hoist for raising motors and rears.

Motor stand.

Jacks.

Emery wheel for grinding.

Cleaning table with plug in bottom to let out kerosene used in washing parts.

Wall cases with compartments or pegs for such articles as stocks and dies, starting cranks, drills and miscellaneous small parts.

Larger garages can have such equipment, of course, as oxy-acetylene welding outfit, kerosene blow-forge, heavy drill press, engine lathe, planer and shaper, miller, radial drill press, surface grinder, cutter grinder and the like, but these rarely are found in the small town outfit.

The heavier sort of repair jobs in the small town are "farmed out" to the machine shops. The equipment in the average small town garage permits such repair and adjustment work as overhauling motors, lining wheels, assembling and tearing down gears and adjusting carburetors. Radiator work is usually a specialist's line and is not attempted by the ordinary garage repairman. This is apt to be true, also, of intricate hood and fender repairs. The time it takes for a workman not thoroughly adept in this kind of work to turn out an acceptable job eats up too much profit.

The workbench, if possible, should be placed beneath windows, to afford light and ventilation for the operators and to let out dust and odors from the work in hand. An electric lamp should be suspended over, or beside each work bench. Reel lights for working under cars are quite desirable.

Many garages sell tires and general automotive equipment and not a few garagemen derive a very large percentage of their profits from these lines. Showroom space—not necessarily a large

space—should be set aside for this purpose, or included in the general office space. There should be a fairly wide counter backed by shelves or bins with a good display therein of motor oils, tubes, spark plugs and the like. Small show cases, or counter cases enhance the appearance of such a department, and a small rack for displaying tires is almost a necessity.

The thoroughly up-to-date garage almost invariably has at least a small show window for displaying goods, tastefully arranged and changed, or reassembled at least once a week. This is one of the most effective kinds of advertising possible. The window should, to a certain extent, indicate what is for sale inside; but at all events the window decorator should avoid trying to crowd too much into the space, thereby producing a jumbled appearance, which is almost as bad as no show window at all, as it looks untidy and confuses the spectator.

If tires and tubes are sold, it is quite logical to have a tire repair and vulcanizing department, although many garages have this where tires are not merchandised.

If conducted right, vulcanizing alone is a profitable business, and a good vulcanizing department should add materially to the income of the garage operator. The equipment is comparatively small and inexpensive, and nearly every car owner sooner or later requires the vulcanizer's services. The vulcanizing outfit is capable of being concentrated in a small space. There are various makes of vulcanizers fashioned with the idea that their user will have little space to spare.

Here is what the small town garageman should have for his vulcanizing department:

A three or four cavity sectional mould.

A retreader.

A tube plate for mending tubes.

A buffing machine.

A tread-roller.

A tire-spreader, to open casings.

A tube deflator.

An air compressor.

A testing tank, or bath, to discover leaks in tubes.

One or two good work benches equipped with mandrels, or elbows for suspending tires and tubes in work, vises and small tools such as stitchers.

A cutting down and cementing table.

A material rack, which can be fastened to the table, or a workbench, thereby economizing space. Usually the materials are suspended on a roll.

Storage rack for tires—completed jobs.

Plenty of metal hooks from which to suspend tires in work—the tires should be kept off the floor as much as possible.

Tread bank for storing sections.

Air or sand bags.

Nearly all general repair work comes under the following phases, with which the vulcanizer quickly becomes familiar: Placing new tread, if tire fabric has not become separated, after removal of old tread, breaker strip and cushion. Relining, or cementing prepared fabric strip and rubber to inside of casing; sectional work, fol-

lowing a blow-out, or break, consisting of cutting away damaged fabric and building up with new fabric; reinforcing, or placing fabric covering inside a tire over small cuts, or back of a section inserted in tire; tread section repair, done as in the foregoing, with the exception that the work is confined to the tread; bead section mending, or replacing part of bead, which is often damaged through tire becoming separated from rim; putting puncture patches in cord tire; cord section repair, or replacing old with new inner or outer cords in cord tire; tube repairs, ordinarily consisting of repairing cuts, or blowouts, putting in new pads, new splices and new valves.

Even a green hand soon becomes used to operating the retreader and sectional moulds and the other phases of repair are picked up in a comparatively short time.

Frequently it is found a paying policy to combine a tire repair department with a battery repair and recharging department; and it is often profitable to obtain the agency for some make of battery, as it is to become an agent for some particular brand of tires and tubes. Batteries, then, are displayed for sale in the show window and a card will call attention to the fact that repairs and recharging are done in the garage, or better still, such a sign can be affixed to the show window, or placed on a permanent sign in the garage front.

The following equipment is found of advantage in conducting a battery repair and charging department:

Lead burning outfit.

Battery thermometer.

Hydrometer syringe for measuring the specific gravity, or density of the electrolyte, or fluid in the battery cell.

Portable voltmeter for reading battery or cell voltage.

Connector-removers.

Special wrench for tightening or loosening sealing nuts.

Screwdriver, or special spanner bit to tighten or loosen bolts.

Putty knife to unseal covers.

Pliers for removing elements from jar.

Receptacles in which to heat and from which to pour sealing compound.

Non-metallic, or lead vessels for storing, mixing and pouring electrolyte.

Rubber gloves to protect the hands from ammonia solution and other spillage.

Stock of battery parts, including sealing compound, burning strip for lead burning; electrolyte reserve for replacing spillage, though never for normal operation; acid-resisting paint for painting cases and petroleum grease for terminals, to prevent corrosion.

System, such, for instance, as a Tungar, or St. Louis Electrical Works apparatus for recharging several batteries at once.

Among the special tools that are found handy in a battery repair shop are the following:

Thermometers, lens front and scientific; branding irons, positive, negative and neutral;

Edison base resistance; steel stamps, positive and negative; finger pipe with six tips; burning lead mould; polarity indicator; separator cutter with gauge and pillar post builders and cone trimmers; reamers, connector-pullers and burnishing brush.

Usually it is good policy to keep the two sections—tire and battery repair—distinct. Sometimes one large workbench is used, but divided by a partition extending into the center of the shop.

If a garage can afford the space for a general stockroom—it does not have to be large—probably ten or twelve feet square will be ample room in a small town—the different kinds of stock should be placed in bins, graded according to size and type of unit. Each bin should be labeled plainly, or ticketed in pasteboard or metal, showing stock list number. Sometimes it is well to keep on the office desk a master sheet, or diagram, numbered as are the bins, so that even a new hand can get the article desired by reference thereto and a quick trip to the stockroom.

It is well to have plenty of shelves in the stockroom: racks, too, if possible; a chest of drawers for small reserve stock and the largest bins should be at the bottom, so that heavy parts will not have to be lifted from an elevated position while the stockroom clerk is on a ladder, or chair.

One very well arranged garage stockroom noted in a small place, has a shaft, open from floor to ceiling, dividing a sort of mezzanine, or gallery, nine feet from the floor and four feet

square. The shaft space, likewise is four feet across. There are bins against each wall underneath each divided mezzanine and in front of all is a deep counter. The whole is partitioned off from the office or showroom space, and a door and oblong window with shelf, on the plan of a cashier's window, give access to the stockroom. Through this window and over the shelf sales can be made, or stock handed by the clerk to the garage operator. (See illustration.)

For a composite garage business, a small service car with box built in, equipped with jacks and towing line for wrecks and balky cars, is desirable.

Almost invariably it pays to have an attractive exterior—especially front—for a garage. In a small town, particularly, this makes the place stand out, and good illumination, like a fair-sized electric sign to get night trade, is a paying distinguishing feature. A bench for customers to take their ease while a purchase is being made ready, or a small adjustment made in the shop is appreciated. So is a rest room for women tourists, be it ever so tiny—and this is within the reach of many a small town garageman. Window boxes and quaint signs to arrest the attention of the motorist are helpful points. And the alert garageman makes a business of belonging to all the motoring and tourist clubs he can join—it has paid many a man to do so, putting him in touch in an unobtrusive way with a large clientele.

CONVENIENT FORMS FOR THE GARAGEMAN'S BUSINESS

NO matter how small the garage, or how limited its field, the business will be more under control when forms are used for recording and comparing the various transactions of the day and month. If records of sales and purchases are not kept and costs compared, it will be difficult, if not impossible, for the garageman to tell whether he is bankrupt, or ahead of the game.

Records can be kept for the small, or medium-sized garage business by the proprietor himself, or one clerk if necessary, but most operators obtain, as soon as business warrants, the services of a competent bookkeeper, for obvious reasons. Standard forms can be purchased, covering all the necessary transactions for an ordinary garage business and some general systems are elastic—that is, capable of expansion or contraction to suit any particular volume, or any special number of lines, or phases.

Each garage operator, however, must work the problem for himself, whether he wishes to have forms covering unusual angles of the business—which some of them do—whether he prefers to have certain results tabulated in a particular way, or whether he will be satisfied with standard methods for office and shop.

For the garageman who does a simple storage business and sells some gasoline and lubricating oil, the problem is simplified. But the garageman, who, in addition to storing cars, sells general automotive equipment, tires and tubes, oils, gaso-

line and greases, new and used cars—as is usually the case in small towns—needs forms whereby he can keep track of each type of operation and know his exact gains and losses at virtually any moment. Many garages have vulcanizing and battery departments, and now and then, even in the small town, a garage finds it expedient to maintain a small repair shop for service and general repairs.

It is not within the sphere of this article to enter into descriptions of the forms needed for the garage where all these lines are engaged in—indeed, there are many types of forms, varying widely, suitable thereto—but it is the intention to outline certain convenient forms, such as index cards, tags and loose sheets which make more facile the handling of the ordinary garage records and accounts. Tastes and inclinations in the matter of forms and business methods are greatly divergent—from the man whose mainstay is a scrap of paper and a spindle, to that meticulous person who trips over his own red tape and has so many ticklers, card index cabinets, loose-leaf systems and books that it takes him, or his clerk all day to find what he wants—if he's lucky. The writer knows of the sales and service departments of an automobile concern that employs thirty-three forms, most of these being checked up daily; and another concern, quite as successful in its way, which uses just five.

The fewer forms the garageman can use, the easier it will be, provided all necessary points are covered, and of course the less will be his overhead in clerk hire and office expenses.

Nearly every garage will find it convenient to use a Cash and Charge Tag. This is usually a manila tag, perforated at the top like an express tag, to tie to the car. It has a job, or serial number, and such items, with charge for each, to be checked off as finished, as the following: Time, Wash, Polish, Grease, Motor, Storage, Vulcanizing, Material Used and Repairs. At the bottom of the tag is a narrow stub to be given to the customer. This stub bears the same number as the main portion of the tag, and is to be presented by the customer when he calls for his car, provided work has been done on it. Where there is simple storage, the customer often gets a paste-board slip bearing just a number and more frequently a number is assigned to his car space in the garage without his receiving any slip. The tag's presentation guarantees that the customer gets back his own car at once, after a job has been finished. Usually no garageman will allow a car upon which work has been done to leave his place without the presentation of this, or a similar tag. The main portion of the tag, itemized and tied to the car when it comes in, and checked off on each item as the work thereon is completed, does away with the necessity of any other job order card in a garage.

As a check on pilfering, as well as for the sake of the maintenance of an orderly record, the wise garageman who has a repair shop, or who handles parts will issue such parts, as well as materials, only on requisition signed by some one in authority—usually, both the foreman and the stock clerk. Such requisitions, when applying only to

O

No.....

Time

Wash

Polish

Grease

Motor

Storage

Vulcanizing

Material used.....

Repairs

.....

No.....

Serial No.....

*We Repair Tires and**Recharge Batteries*

JONES, SMITH & CO.'S

GARAGE

Main and Appamattox Streets

CASH AND CHARGE TAG.

Manila tag, giving job order number at top and covering items of Time, Wash, Polish, Grease, Motor Storage, Vulcanizing, Material Used and Repairs. Where the garage has no vulcanizing department, of course, this item, like any other not covered by a charge, is left blank. At bottom is stub with job order number and serial number, to be given to customer who presents it for his car.

parts, itemize quantity, part number, description and price. A small card or slip suffices, bearing in addition, the name of the party to whom delivered and specifying to what job number the articles thus drawn are to be charged. This slip can be used for oil and gasoline, by writing these items in. Because of the use of other forms where these items appear, however, this is not necessary.

Oil and gasoline ordinarily appear on the monthly statement, as well as on the Sales and Purchase Record. Here is one method of keeping it:

The Sales and Purchase Record records daily sales of each article separately, the forms tabulating the sales for one month, which is indicated at the top. Days of the month are shown in a column to the extreme left. Then come in order columns for oil, gasoline, tires, accessories, service and the total of sales. In the right-hand division of the form, under the heading, "Purchases," these items are repeated, though the single column of days of the month suffices for both. The days of the month can be checked off in figures above each numbered day of the week, or a special column for them could be ruled in.

A Cash and Expense Record, checked up daily, is a necessity. Some garages find it convenient to use the form as follows:

This form accounts for cash on hand, bank balance, accounts receivable and payable, and the expense account closely itemized. Under such expenses, for instance, will come rental, salaries, advertising, heat and light, taxes, insurance, tele-

October SALES AND PURCHASE RECORD

Sales						Purchases					
Oil	Gas.	Tires	Access.	Serv.	Total	Oil	Gas.	Tires	Access.	Serv.	Total
1
2
3
4
5
6

Form to keep track of sales and purchases for garage.

phone charges, oil and gasoline, tires and tubes and miscellaneous—the latter a very handy heading to “pigeonhole” anything else.

Entries are made daily. Under the subdivision Cash, come Total Cash Received, Total Cash Paid, and Cash Balance on Hand. Under Bank Balance come Amount Deposited, Amount Withdrawn and Balance in Bank. Under Accounts Receivable appear the entries Credit Sale, Amount Received on Account and Balance Receivable. Under Accounts Payable are entered Purchase, Paid on Purchase, and Balance Payable.

The month is indicated at the top and at the extreme left is a column for days of the week. The days of the month can be added as suggested in the foregoing. As each day ends, all the cash taken in is entered in the column assigned, or “Cash,” and the money paid out, including that deposited in bank, is placed in the column devoted to that purpose. Adding the amount of cash received for the day to the cash on hand at the end of the previous day and subtracting the sum paid out, gives the amount on hand with which to begin next day. The Bank Balance and Accounts Receivable and Payable are handled likewise, showing at the day’s close the state of finances, the sum owed and the total of accounts receivable.

Every garage should have a monthly statement form. This usually has the following entries: Name of owner, his address, the date, the make of his car and its style, and the car’s license number, all at the top. Opposite a set of

October

CASH AND EXPENSES

Cash			Bank Balance			Accts. Receiv.			Accts. Pay.			Expenses										
Total cash rec'd	Total cash paid	Cash bal. on hand	Amount deposited	Amount withdrawn	Balance in Bank	Credit Sale	Amt. rec'd on Accts.	Balance receivable	Purchase	Paid on purchase	Balance payable	Rent	Salaries	Advertising	Heat and light	Taxes, Ins. and Interest	Telephone	Oil and gasoline	Tires and tubes	Misc.	Total	
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Garage Cash and Expense Record,

ruled columns, the first for the days of the month, from 1 to 31, and the others for gallons and rate of gasoline, and quarts and price of oil, are the entries. Storage for the month, gasoline, gallons per statement; oils and grease, per statement, dates of sales and sundries.

It has been found a convenience to have printed at the bottom of the form a special set of columns and spaces for credits. Whoever does the actual selling signs the statement in the space allotted therefor, at the bottom. This form is in duplicate, the white original being given to the customer and the colored copy retained by the office.

On plain billheads, and sometimes on all forms, a garage owner, in the interest of saving misunderstanding and trouble with customers, will have printed the following legend: "Not responsible for articles left in car, or for loss or damage by fire to the vehicles left with us for storage, sale, or repair."

The Stock Record, a sort of perpetual form, whereby the garage owner can know at any given time just what he has in stock by checking up, or even what are his daily profits, usually is divided into as many sections, or divisions, as there are types of stock. Let us, for instance, take for the sake of simplification, an ordinary one, divided into Cars, Tires and Gasoline.

Under Cars come the subdivisions, or column-headings: When Entered, Stock No., Make, Size, Cost, Sold for and Date of Sale. Under Tires, the headings are the same, with the exception that the word "Brand" is substituted for "Make."

Under Gasoline the column-headings are: When Entered, Amount of Purchase, Cost per Gallon, Amount Sold, Cost, Selling Price and Profit.

Every separate article of stock, of course, receives a stock number when it arrives and this number is always entered in the record and on the article itself.

The articles of stock are then entered, as shown by the column headings, in relation to the date when they are received, the stock number, the kind of article, the size, the cost and the selling price. When an article is taken from stock, an ordinary sales slip is made out and on it are placed the stock number, the name of the article and its selling price. The slip is sent to the bookkeeper, who checks in the Stock Record this article as sold. The bookkeeper also jots down the cost and selling price of the article on a special slip, in the case of every article sold during the day and adds up, at the day's end the costs of all articles sold; the selling prices of these articles—added separately, of course—and then subtracts cost from selling price, giving the day's total gross profit.

There are two popular methods of keeping "Customers' Cards" that will be described here. The most usual is to have an index system in connection with the ordinary filing cabinet, the filing being done by customer's name, alphabetically. Let the cards, for instance, be 8 by 5 inches, giving customer's name, address and telephone number at the top, with the following column headings below: Date Arrive, Price, (meaning rate), Number of Car, Name of Car, Car Length

Forms for the Garage

47

<div style="display: flex; justify-content: space-between;"> <div style="text-align: left;"> STORAGE MODERN GARAGE SERVICE ACCESSORIES Broadway and Goode Street </div> <div style="text-align: right;"> REPAIRS </div> </div>									
Owner		Address							
Car		License No.				Date			
Statement for month of						Day	Gasoline		Oil
							Gals.	Rate	Qts. Price
						1			
						2			
						3			
						4			
						5			
						6			
						7			
						8			
						9			
						10			
						11			
						12			
						13			
						14			
						15			
						16			
						17			
						18			
						19			
						20			
						21			
						22			
						23			
						24			
						25			
						26			
						27			
						28			
						29			
						30			
						31			
Total									
Credits									
Total									
Amount due						Total			
<div style="display: flex; justify-content: space-between; align-items: center;"> <div> <p>Received Payment.....19...</p> <p>All Bills Due Upon Presentation</p> <p>Receipts Mailed Only On Request</p> </div> <div> <p>MODERN GARAGE</p> <p>Per</p> </div> </div> <p style="text-align: center;">Not responsible for articles left in car, or for loss or damage by fire to the vehicles left with us for storage, sale or repair.</p>									

Model monthly statement for garage.

and Width, Extra Wash and Date Out. This, of course, is a live or semi-live storage card, and does not cover repairs or other phases of care. Any remarks as to customer or car can be written on the blank back of this form. The entries, "Length" and "Width," are especially useful when the garage operator conducts a "garage layout chart" with spaces drawn to scale for each car.

By such a method a garageman can tell exactly what space he can assign to a car.

The other method referred to, of keeping "Customer's Cards," is as follows: In a wall case, like a miniature set of bins, are placed these cards, each having its separate small compartment. Let us suppose there are 150 cards and compartments. Generally the compartments are made large enough so that they can be subdivided as clients increase. These cards and compartments are for regular customers, not transients. If the garage is run on the plan of live, semi-live and dead storage, cards in these classes will have a distinctive color for each—say red for live, yellow for semi-live and white for dead. Each color has the significance to the garageman, of the particular class of care that must be taken of the car thus represented. If he sees many red cards in the compartments, he knows, for instance, that he will need plenty of washers on hand to look after them.

The cards are usually from 3 to 4 inches high by an inch and a quarter, wider than that. They are filed by Garage or Car Number, and Customer's Name. In addition there appear the fol-

lowing entries: Customer's Residence and Business Addresses and Telephone Numbers; License Number; Make of Car, Engine Number, Tires and Rims, Date In, Rate, Model, Manufacturer's Number, Date Out and Remarks. On the reverse side are these entries: Month, Date by Day of Month, and In and Out for checking as the car enters and leaves. These cards are renewed monthly.

OBTAINING THE COST OF REPAIR WORK

ONE of the requisites of a successful business is proper systemization, and without it no business can succeed. This does not mean that it is necessary to provide an elaborate system to cover all conditions, but it does mean that no business can exist without a legitimate profit. In other words, the first requisite of operating a business successfully is to know the cost of doing business. A system involving considerable clerical work would eventually mean disaster to the small or new repair shop, but a simple system, which will permit expansion as the business grows, should be adopted. Accurate costs of all repair work should be obtained. This will include the repairman's time, which is designated as labor, material, parts and supplies used, the cost of work sent outside the shop, and the fixed expenses which are termed overhead expenses. Overhead covers such items as rent, power, light, water, telephone service, insurance, taxes, etc.

[illegible]

Fig. 1.

This information is just as important in a small shop as it is in a large shop, especially in such a business as motor vehicle repairing, where a number of items are involved. The first impression is that the necessary methods to gather and analyze this information is too complicated and expensive for a small business. This is not the case, however. Methods and procedure economical in a large business may be impractical or undesirable in a small one, but the principles involved are adaptable to the smallest establishment and are becoming more and more indispensable to the small business man who has vision and ambition to expand and become the big and successful operator of the future.

A very simple system for a repair shop that was originally worked out for a small branch house by a manufacturer of cars and trucks is illustrated and described herewith. In this system the object is to determine the labor and material used for each job, so that the actual cost can be obtained to which the overhead and profit may be added to determine the charge that is to be made. The system consists of three different forms which are inexpensive. One form designates the work to be done, the second covers the time required for the work, and the third is a shop requisition which covers material, parts and supplies.

When a car is sent in for repairs the owner's name is entered in a job record book and the work is given a job number, the number and name being entered on the card shown in Fig. 1. This card is then attached to the car to identify it and

Time Started		Hrs.	Rate	Amt.	Time Finished
	Order No.				
	Item No.				
	Check No.				

Fig. 2.

the work which is to be done. Now suppose tires or tubes or any other part of the car are to be repaired. A coupon is then filled out by the man in charge and attached to the part, authorizing the workman to repair same. The idea of the coupons is to instruct the workman as to exactly what work is to be done on that part. The larger card, or Coupon No. 4, always remains attached to the car, and contains the complete instructions for all work to be done on the car. While this form consisted of four coupons, any number may be used, or in special cases, where a number are required, several complete cards can be wired together, as the job number forms the identification. The form should be perforated so that the coupons can easily be removed.

In Fig. 2 is shown the time card used in keeping account of the labor on the different parts. This card also has three coupons, as a workman is most likely to work on more than one job during the day. The lower coupon serves as a time card for the workman, from which the pay-roll can be compiled. The coupons cover the individual items and the men are required to turn in the four coupons every evening and the next day they are filed according to job numbers, together with the coupons of the special shop order, so that the cost of a job can be ascertained in a few minutes.

Fig. 3, which is a shop requisition on the store-room, takes care of parts, material and supplies used. These requisitions are filed in the same manner as the coupons of the shop order and time cards. Any work which is sent out of the

Card No. 5.

SHOP REQUISITION.

.....Dept. Date.....192..

Delivered to.....Dept. Charge to Card No.....

No Ordered	No. Delivered	Name of Article	Unit Price	Amount
(Six Blank Lines.)				

.....Foreman.

Fig. 3.

shop is covered by an order bearing the job number and a copy of this is filed with the above, so that complete records may be had instantly.

When a job is completed, the actual cost is computed from these forms, after which they are placed in an envelope which bears the owner's name and the job number. This envelope is filed under the owner's name for future reference. Thus it can be readily understood, that the actual cost can be had almost as soon as a job is completed. This feature alone is well worth the cost of printing the cards.

This covers the determination of the actual cost. However, there are other items mentioned above which must be determined to obtain the total charge to be made. This is the overhead or fixed expense. This can easily be determined by tabulation, so that its relation in percentage to the actual monthly cost of repair jobs can be

determined. This percentage is then added to the actual cost, after which the percentage of profit is added to determine the actual charge to be made for the work.

Fixed expense items should be considered as follows:

Rent. Whether actually paid during the month or not, one month's rent should be included in the monthly overhead figure. If you own your own property, charge the business a reasonable rental anyway — if the business cannot stand a rent charge you had better get rid of the business and rent your property to someone else. Charge as rent whatever you could rent the property for to an outsider. Or figure 7 to 9 per cent of your investment in the property as an annual rental and charge the business one-twelfth of this amount as rent.

Taxes. This item will cover the personal property taxes on the business, but should not cover real estate taxes, as this is taken care of in the rent. This must generally be based on the previous assessment, plus a reasonable percentage for any additions in machinery and equipment which may have been made.

Insurance. One-twelfth of the annual premium on all insurance policies in force should be added. Fire insurance on the building should not be considered as this is included in the rent. Heat, light, water, telephone and power; these items generally form an average monthly cost which can be determined from previous bills and an average taken. Large supplies of fuel purchased in one month for heat must be distributed

over the period which they will cover. If any of these items are paid quarterly, the monthly proportions should be added each month.

Depreciation is another item which must be considered, and while this is hard to estimate, 1 per cent is generally used, being based upon a complete inventory of all equipment and office furniture.

The total of these items plus any non-productive labor, such as a clerk, stenographer, etc., forms the total overhead expense. The relation of this in per cent of the total actual monthly costs gives the percentage to be added to the actual cost of any job.

The idea to be fixed firmly in mind is that the overhead expenses are actually as much a part of the cost of a job as are the dollars that are paid for labor or parts to be used on that particular job.

Some large repair shops will estimate the cost of repair work, but this is not practical for the small shop, as estimates are usually based on records of the average time consumed for doing the job plus what is termed a factor of safety and the overhead expense. It is suggested, however, that a record be kept of certain standard work, such as cleaning out carbon and grinding valves; that is of a particular type of engine or model. Other overhauling jobs can be treated in a similar manner, but it should be remembered that the fastest workman is not always the most efficient. With records dealing with labor and material charges one can, in time, estimate certain work.

This article is not intended as a treatise on cost accounting, but it is hoped that from it the reader may obtain an idea of the principles involved, so that he may be able to place his repair business upon a profitable basis.

TOOLS FOR MOTOR WORK

The Uses They Should and Should Not Be Put To—Their Care and Adjustment

PRELIMINARY to starting work on the motors in the garage or shop, the workman should have at least an elementary idea and knowledge of the various tools he will handle. He should know the use to which each instrument should and should not be put, the proper method of using wrenches, hammers, etc., and how to take care of the tools so as to avoid their damage and breakage. Tools which are handled in the proper manner and carefully kept, will give long and good service; but it is a surprisingly easy matter to break even those that are heaviest and strongest by using them for purposes other than those for which they were designed. And, in order to know just what purpose each tool is for, it is necessary to know the various types of each kind. We will therefore take up in detail the tools that are in most common use in a shop, and which are most used in motor work.

WRENCHES

Most wrenches are used for turning nuts, bolts, cap-screws, and small parts with square or

hexagonal cross-section, such as clevises, turn-buckles, etc. There are also special types designed for turning parts of round cross-section. Wrenches can be classified as follows:

The Monkey Wrench

This is an adjustable wrench with a side opening, and comes in many sizes, generally from six to twenty-four inches in length. It is a strong and durable tool when used as a wrench, but makes a handy hammer, with the result that it is often broken when used as such. When using this type of wrench it is important to have the adjustable jaw taken up tight on the part that is being turned, or the jaws will be spread or broken when force is applied. Better service will be obtained if the wrench is used flat, and, when the wrench is turned, the adjustable jaw should always be leading — that is, it should be in compression, the fixed jaw being in tension.

The Automobile or Bicycle Wrench

This type is very similar to the monkey wrench, but it is thinner, and one of the jaws and the handle are usually forged in one piece. It also comes in a wide range of sizes, and its use and care are similar to that of the monkey wrench.

Open-End Wrenches

This type comes in several different forms, but, as its name implies, has the jaws opening at the end of the handle. It is not adjustable,

and separate wrenches must be used for turning nuts and bolts of different sizes. The handles of open-end wrenches are made in both straight and curved form. (Fig. 1.) Those with straight handles are called "straight shank" wrenches, and those with the curved handle are called "S shank," because the curve usually takes this shape.



Fig. 1. Open-end wrenches.

It is often possible to reach parts in inaccessible places more easily with the "S shank" type of wrench. Open-end wrenches come with jaws at one or both ends of the handle. If a wrench has jaws at one end only, it is called "single"; if it has jaws at both ends, it is called "double."

The double wrenches usually have sets of jaws which will take two different sizes of nuts or bolts. In making up a kit of tools, therefore, it will be a great saving, especially in weight, to equip with the double-end type. (Fig. 2.)

Adjustable Open-End Wrenches

This is an adaptation of the monkey wrench principle to the open-end wrench, and, as its name implies, is an end wrench with adjustable jaws. It is a particularly handy tool to have about a repair shop, and it is supplied in several different sizes with straight and curved handles, and with jaws at one or both ends.

In the United States there are in common use several distinct standards as regards the dimensions of small stock, such as bolts, nuts, unions, etc. The three main standards used are the—

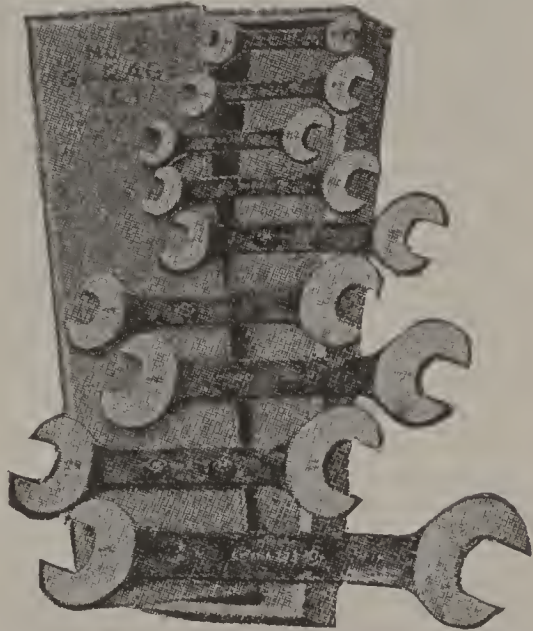


Fig. 2. Garage set of wrenches.

U. S. S., or The United States Standard ;
S. A. E., or Society of Automotive Engineers ;
A. S. M. E., or American Society of Mechanical Engineers.

The latter two sets of specifications were recommended by engineering societies and have been widely adopted by engine manufacturers. Different steels are called for in the various specifications, and the style of thread and diameter of head size vary in bolts having the same diameter.

It is to be noted that the size of a bolt or cap-screw is always given as the diameter of its stem before the threads are cut into it. And inasmuch as the head sizes vary with the style of thread cut in the stem, it will be seen that a fixed jaw wrench of the open-end type that will exactly fit a U. S. S. bolt will not fit a part having any other thread, even though the part be described as being of the same stem diameter.

To explain more fully, let us take an example: A wrench which fits a $5/16''$ U. S. S. bolt will be too big for a proper fit on a $5/16''$ S. A. E. bolt. This difference in size is often sufficient to make it impracticable to use the wrench without danger of spreading the jaws or rounding off the corners of the head of the bolt. There is also some variation in the size of the heads of bolts and capscrews having the same stem diameter, and, as bolts and nuts of different style thread are often used on the same motor, it can be readily seen that it would be necessary to have an excessively large number of fixed jaw wrenches to fit them all properly.

From the foregoing, the advantages and the utility of the open-end adjustable wrench will be apparent. These wrenches have sufficient range of opening to take all sizes of parts up to $1/4''$, $1/2''$, or even $3/4''$, depending upon the actual size of the wrench. All variations in bolt head size can be readily taken up by the adjustable action of this type of wrench. However, this wrench will not stand abuse, and must be carefully handled; it must not be used upright,

nor unless the adjustable jaw is in compression against the fixed piece.

Socket Wrenches

Socket wrenches are undoubtedly the most satisfactory of all types for use on motors, and in most shops their use is insisted upon wherever it is possible. In this style wrench the socket is placed over the part to be turned, and bears on it on all sides. Nuts can be taken up very tightly with little difficulty, and there is much less danger of burring the corners of any part on which a socket wrench is used.

Socket wrenches come with fixed or removable handles (Fig. 3.) The fixed wrench handles are usually in the form of a "T" or "L." The "T" handle is the most common type, but the "L" handle is very convenient for get-

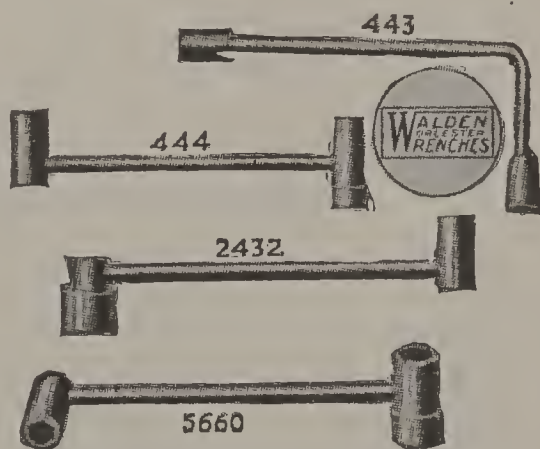


Fig. 3. Socket wrenches.

ting at bolts or nuts which are situated under some projecting part of the engine, such as a magneto bracket, water pump support, etc.

It is also possible to obtain socket wrench sets (Fig. 4). These consist of a number of sockets differing in size, but all adapted to accept the same handle, which is secured temporarily in

position by a simple form of catch. These sets are very convenient and are a great saving in weight, as a single handle will suffice for use with all the sockets. The handles come in

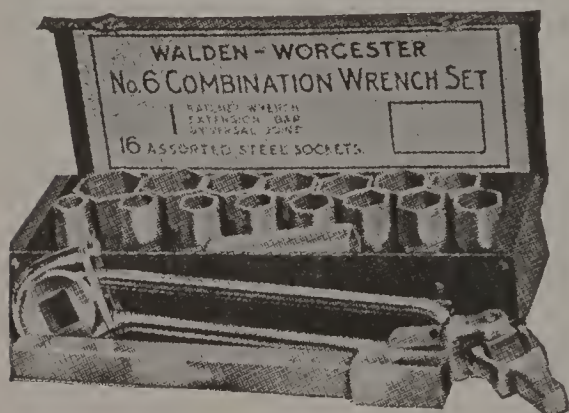


Fig. 4. Socket wrench set with extension bar.

both the "T" and "L" form, and it is also possible to obtain a universal joint attachment which is adapted to fit between the socket and the handle and enables the user to reach nuts

and bolts located in the most inaccessible positions.

The "Bull-Dog" or "Alligator" Wrench

This wrench is primarily a lazy man's tool. It consists of a handle with two diverging jaws, with teeth or serrations cut in the inner sides of the jaws. It takes any size nut or bolt on which it is placed, and promptly ruins the part as it gets its grip on it by biting into the sides. Good work cannot be done with this tool, and its use should not be allowed in a repair shop.

The Stilson Wrench

This wrench is used for turning parts of round cross-section. It has adjustable, side opening jaws, so designed as to cut into the part to

which they are applied, and the harder the wrench is turned, the harder the jaws bite into the part. It is essentially for use on iron pipe, and there are few, if any, places on a motor where it can be used to good advantage. However, if a soft nut were to have had its corners rounded off when put on, and it was impossible to remove it with a straight jaw wrench, the Stilson would be the only recourse. But, generally speaking, as regards motor work, the Stilson and Alligator belong in the "plumber" class.

The Spanner Wrench

This wrench is used only on spanner nuts, and a special wrench must be used for each size and style nut. The spanner nut is very flat and has a round cross-section. Either holes are drilled or teeth are cut in its outer circumference at regular intervals, and the spanner wrench is shaped to fit around the nut. The wrench carries a lip or pin which fits into a tooth or hole, as the case may be, and pulls the nut around as the handle is turned. If the wrench carries a pin, it is called a "Pin Spanner," and if it carries a lip it is called a "Hook Spanner." Spanner nuts are not commonly used on motors except in certain conventional places, such as the thrust-bearing adjustment, large water connections, valve caps, etc.

Special Wrenches

Special wrenches of all types and descriptions are needed for the rapid dismantling and assembly of most motors. And in some cases it is

absolutely necessary to have a special tool to be able to remove the part at all. In these instances the tools are usually provided by the manufacturer of the engine.

The general rules for the use and care of wrenches can be summoned up as follows:

Always use a wrench that fits snugly the part to be turned.

When using an adjustable wrench, see to it that the movable jaw is taken up tight on the part to be turned and that the movable jaw is being forced up against the fixed piece and not pulled away from it.

By observing these simple rules, more satisfactory service will be obtained and danger of breakage will be reduced to a minimum.

HAMMERS AND MALLETS

Machinist Ball Pein Hammer

This type hammer is in most common use in the shop, and can be obtained in almost any weight, ranging from a few ounces to several pounds. It is made of steel and the striking edge is somewhat convex, the back of the head being ball-shaped. This hammer is used for all heavy work about the shop, the ball end being used mainly for riveting cold. It is seldom that any part of a motor should be struck with a steel hammer, but where force is needed a block of some comparatively soft material can be placed against the part, and the blow dampened through it.

The Carpenter's (Claw) Hammer

This is the familiar "family" type. It is used mainly for the driving and drawing of nails. The striking surface is flatter than that of the machinist's hammer, and the claws at the back of the head are for the purpose of gripping the nail which is being withdrawn. There is little use for this type hammer in motor work, but it is usually found around a shop where some carpentry is done.

Brass and Bronze Hammers

Hammers of comparatively soft metal can be used with less danger around an engine. Hardened parts will not be damaged if tapped with a brass or bronze hammer, but great care must be taken to avoid bending or misalignment.

Lead and Babbitt Hammers

These hammers are of still softer metal than brass, but are just as heavy. It is impossible to lay down specific rules as to when various hammers should be used, and the choice of the proper one is very much a matter of ordinary judgment. A hammer of harder material than the part to be struck should never be used, and in any case where driving is necessary, it is advisable to interpose a block of some softer material, to prevent damaging the part to be driven.

Raw-hide and Wooden Mallets

These mallets are usually quite light and are used mainly on light castings and small parts.

(Figs. 5 and 6.) Often when removing cover plates the plate will be found to stick in position even after all the retaining bolts or capscrews are taken out. In this case, if the edges of the plate be sharply tapped with a raw-hide mallet, it will



Fig. 5. Light wood mallet.

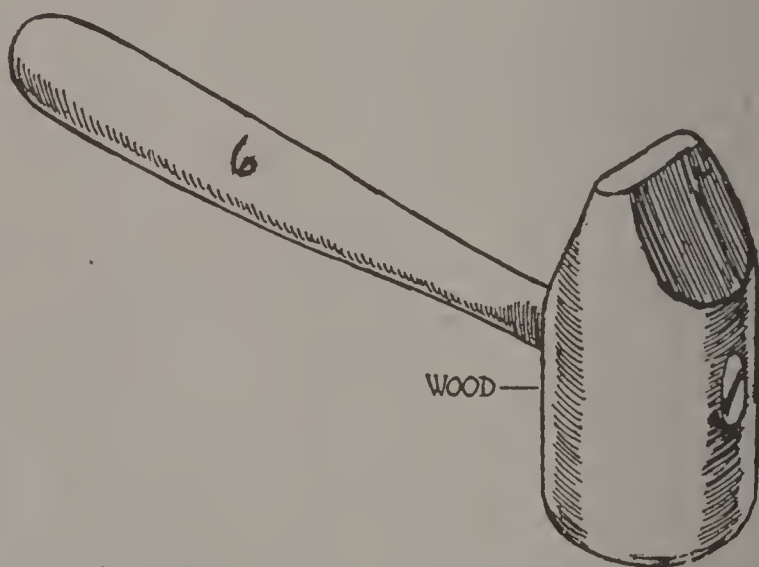


Fig. 6. Heavy wood mallet.

be loosened without damage. This method should be used instead of forcing a sharp-edged tool behind the plate and prying it off, as in the latter method there is great danger of bending the part, and, if the gasket is used at that point, it will be unfit for further use.

Hard Rubber Mallets

Mallets are also made of solid rubber. They are usually very large and heavy. Great force can be exerted on a part with a mallet of this material without danger to the part which is struck. It is used mainly for the lining up of shafts or brackets which have become misaligned.

SCREW DRIVERS

The Fixed-Handle Screw Driver

This type needs no description. It can be obtained in all sizes, from an inch or two to over forty inches in length. It is used for turning wood screws, machine screws, and bolts and cap-screws with slotted heads. It is also often used to insert in the slotted head of a valve to grind it to its seat. It is to be remembered that a screw-driver is to be used for the above-mentioned purposes and is not to be used, except in emergency, for prying. Crow-bars are provided for this purpose. Nor should screw drivers be used as wedges to be driven between parts in order to separate them, and in no case is a hammer to be used on a wooden-handled screw driver.

The Spiral Ratchet Screw Driver

This is a special form of tool for rapid work. The handle is fixed to a cylinder having an internal ratchet tooth. The shank of the screw driver is attached to a rod in which a worm is cut. The handle is slid back and forth over the rod, the internal tooth riding in the worm in the

rod. As the handle is held tight, a rotary motion is thereby imparted to the rod which carries the shank of the screw driver.

As the tooth is a ratchet, there is no motion imparted on the backward motion of the handle, and as the worm is usually cut in both directions around the rod, and as the direction of the tooth can be changed, the machine is reversible and can be used for removing screws as well as putting them in. A collar in which the rod is free to turn, is placed at the lower end, and this provides a convenient grip for the user. The mechanism can also be locked and the screw driver used as the ordinary fixed-handle type.

The Off-Set Screw Driver

This consists of a rod called the handle, at either extremity of which is a shank forged integrally with the handle (Fig. 7), but bent through an angle of 90° . The direction in which the shanks are bent also differs by 90° . The shanks are extremely short and permit the user to reach screws which are placed directly under some projecting part of the engine and which, consequently, cannot be reached with a straight screw driver. It is a very handy tool and often helps out in a tight situation.

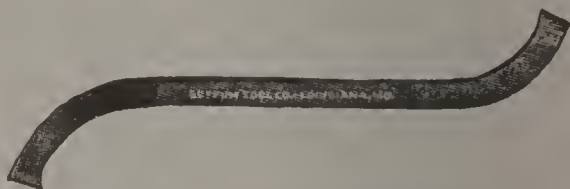


Fig. 7. Offset screwdriver.

Special Screw Drivers

Special screw drivers are usually supplied by the manufacturers of such instruments as magnetos, carburetors, etc. They are generally of primary use in the dismantling and assembling of the special apparatus with which they are supplied.

PLIERS

There are innumerable types and forms of pliers, some of which are very useful, and others which are of little value to a mechanic. The four most satisfactory types can be classified as follows:

The Combination Gas Pliers

This tool is invariably found in the automobilist's kit and it is used by novices for almost every purpose, from turning nuts to hammering. In the shop it will be found that there is little actual work for this tool and that better results will be obtained by using tools designed for special purposes. It is also to be noted particularly that pliers should not be used on nuts or heads of bolts and cap-screws.

Side-Cutting Pliers

This is a special form of pliers, sometimes called the "electrician's" pliers, as its main use is in wiring work. It is especially handy for cutting wire and for removing insulation.

Oblique or Diagonal Cutting Pliers

This type is also adapted to electrical work, and, the cutting edges being offset at an angle, wire can be cut very close to a terminal, thereby preventing danger of short-circuits through long loose ends.

End-Cutting Pliers

In this type the cutting edges are at right angles to the handle. It is used mainly for cutting piano or hardened steel wire. Its main use in engine work is in the connecting of motor control wires.

FILES

Files can be obtained in all shapes and sizes, but those most commonly found in the repair shop are: Flat, Square, Round, Half-Round, Triangular. Files with different styles of teeth are used for different degrees of cutting, the "bastard" type being used for the rough or first cut, the "second cut" for lighter work, and the "smooth" for finish work.

All files are exceedingly hard and brittle and must not be used for any purpose except actual filing. They must not be carried unprotected in a tool-box, and they should be carefully cleaned after being used. File brushes can be obtained wherever files are sold, and no kit is complete without one. The essential point to remember in the use of files is that they are made to cut in one (the forward) direction only, and no force should be applied on the backward motion.

Failure to observe this rule will dull a file rapidly, and, in some cases, make it unfit for further use. The manner in which a man uses a file is usually indicative of his ability as a mechanic, and it is therefore of extreme importance to know the proper method of using this tool.

VICE

There is no shop tool that is in greater demand nor upon which one should be able to place greater reliance than the vise. It behooves the mechanic, therefore, to see to it that the vise mounted on his table is a proper one, and furthermore, that it is solidly mounted against "shake," for with a vise that is loose it is next to impossible to turn out the best of work, and nothing is more trying and exasperating to the workman than to have a vise which will not "stay put."

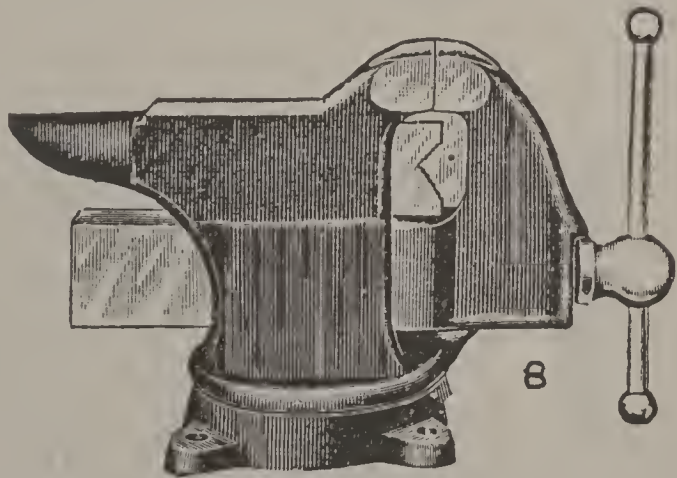


Fig. 8. Combination vise of excellent service

In Fig. 8 is pictured a most handy type of vise for garage service; it is solidly made of the best of material and is desirable for the reason that it is of the combination type, adaptable to take straight work and pipe work as well. A point to remember in

using any vise is to use “soft jaws”—that is, jaw liners made of sheet lead or brass, or even wood—when holding work which must not be marred. Jaws of this type are for sale at all good hardware stores, or can be made up in a few moment’s time by the mechanic.

CHISELS AND PUNCHES

With metal work, unlike wood work, it is practically impossible to mark the work with a pencil. Points to be marked, therefore, are generally “punched,” and a series of punch marks determines a line; in some cases, a line will be scribed with a steel scribe, the sharp hard point of which actually digs the line into the surface of the metal. Two types of punches are used for this work—the prick punch with a sharp point, which is used in the preliminary work, and the center punch with blunt point, but which is adapted to stand a heavy hammer blow and sink deeply into the metal, leaving a punch-mark which cannot be easily overlooked, and which, moreover, is sufficiently deep to give a “bite” on a drill point, keeping it from “walking” until the cutting edge has actually started in to work on the metal.

From the very nature of the tools it will be appreciated that the prick punch is to be used only in conjunction with a comparatively light hammer; with the center punch, on the other hand, depending on the size of the punch and the hardness of the material into which it is being driven, medium and heavy hammers can be used.

The thing to bear in mind is not to use the punches on material harder than the steel of the punch itself, and to keep the punches ground true and at the proper angle.

There is another punch which is part and parcel of the auto mechanic's equipment; that is the pin punch or drift, illustrated along with the others in Figure 9. It has a cylindrical end, quite blunt, and is used to drive pins from holes, drift holes into alignment, etc., etc. This punch is made in various sizes to fit it to any particular work.

Also shown in the same illustration and also used in con-

nection with pins, is the cotter pin tool, which looks very

much like the offset screw driver

already referred to.

It is a handy little steel tool which is used both for with-

drawingsplit pins and for bending over the nibs when they are put in position.



Fig. 9. Punches and cotter pin tool.

Metal chisels are commonly of two varieties—cape chisels, shown in Fig. 10, and cold chisels. The difference is that the former are usually narrow with very heavy blade and body, the cutting edge ground to suit the work in hand. The

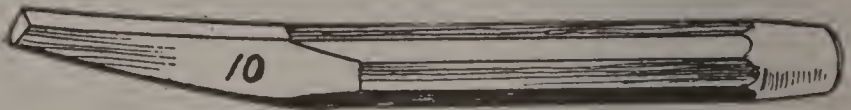


Fig. 10. Cape chisel.

cold chisel, on the other hand, has a flat blade, with a blunt point. The character of the work will determine which chisel should be used.

In use the chisel should be held firmly up to the work, which should be held solidly in the vise; a medium-weight hammer and smart, direct blow on the end of the tool give the neatest work and the quickest action. The chisel should be ground to the correct angle as frequently as it loses its edge, and should not be used when the edge is chipped. In grinding, it is important that the tool be cooled frequently, else the temper will be drawn from the cutting edge and the tool will be worthless.

DRILLS AND SCREW CUTTERS

The importance of keeping twist drills which are used for metal work, in prime shape, is made

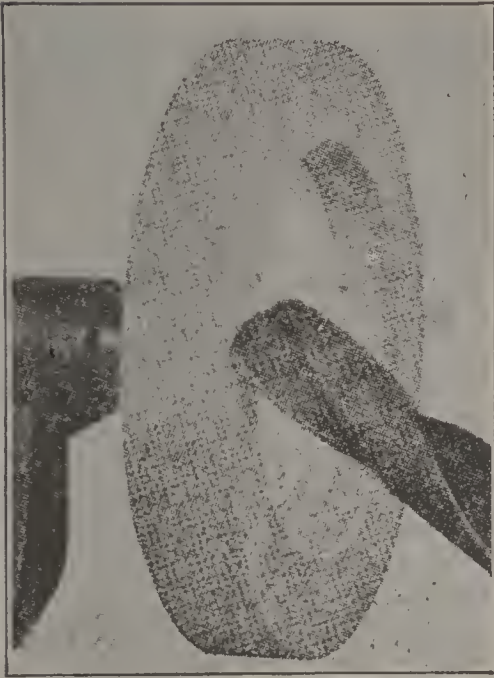


Fig. 12. Proper method of starting to grind a drill.

perfectly clear by reference to Fig. 11. The drills, when new, should be noted, the lip lengths measured as shown in Fig. 13, and the lip angles also made note of as indicated in Fig. 14. When it comes time to regrind the drills, the mechanic will then have little trouble in restoring the drill to its proper condition, which is so necessary if good work is to be accomplished. The method of grinding

the drill is also important. The side of the wheel should be used and not the face, for the latter will give a "hollow" cutting edge, which is not at all desirable with a twist drill; the correct method is shown in Fig. 12.

In using the drill it is important that the metal being drilled be softer than the drill itself, else the latter will break or will quickly lose its cutting edge. Tempered or hardened steel should not be drilled until it has been softened to the

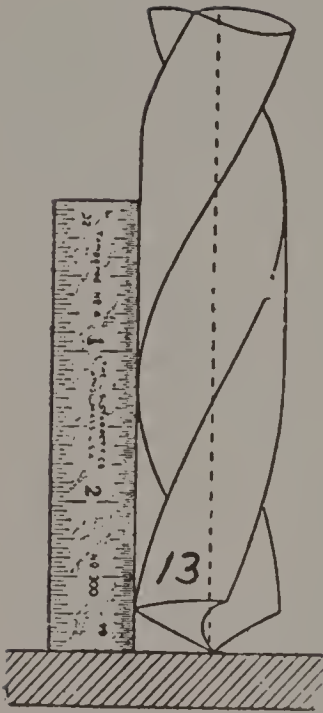


Fig. 13. Method of measuring cutting lip length.

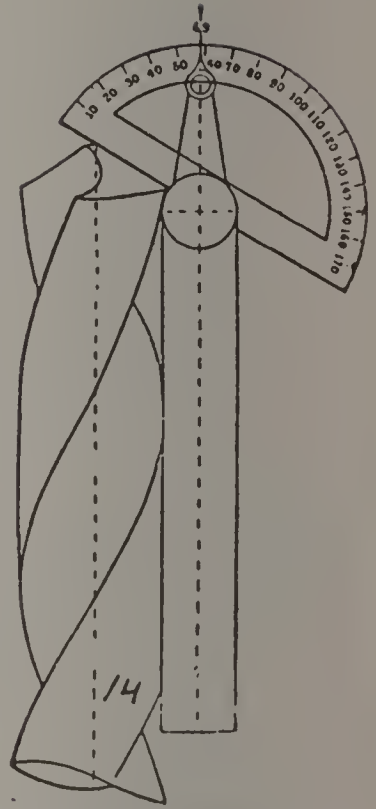


Fig. 14. Measuring lip angles.

proper degree by heat treatment and slow cooling. It should also be borne in mind that the drill should be run at the proper speed for the



Fig. 11. Results of improperly ground drills. Left—Unequal lip angles. Middle—Unequal lip lengths. Right—Both lip angles and lengths unequal.

work in hand and that it should not be "forced" with the feed, for if forcing is resorted to, the hole drilled will be "off," the drill dulled or broken, while at the same time the work will be delayed rather than speeded. It is best to have a good sharp drill in prime condition and let it take its natural course. Where the drilling work is heavy, it will be necessary to lubricate well with lard oil or some special cutting oil and to withdraw the drill from the work frequently to clear it of chips.

A good set of taps and dies, as illustrated in Fig. 15, is a most important item of equipment. It is well to determine exactly what is wanted in the way of standards and sizes, and then

buy a good set that will fit the conditions. It is worth while mentioning that at the present time the S. A. E. standard is the one chiefly used throughout the automotive industry, except on the softer metals, such as aluminum and cast iron; here, because of the fineness of the S. A. E. threads in comparison with the U. S. S. for

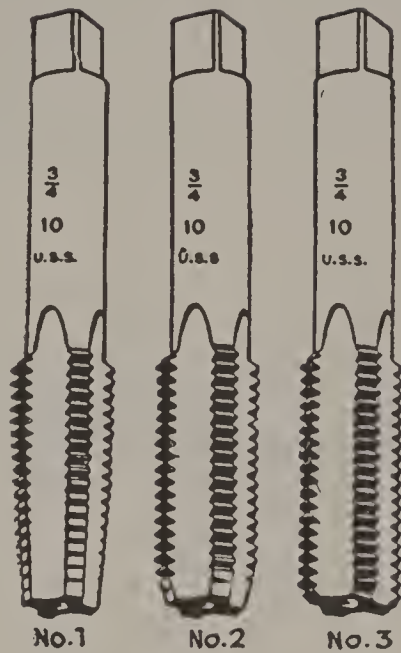


Fig 15. Taps.

the same diameter screw or bolt, the latter is used. For all steel work, however, it will be found that the S. A. E. standard is prevalent.

In determining which taps and dies to buy, the screw-thread gauge shown in Fig. 17 is

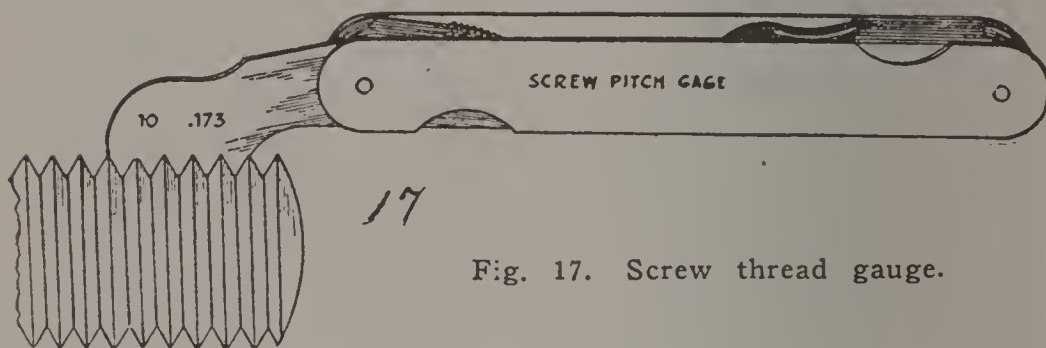


Fig. 17. Screw thread gauge.

handy; the illustration shows clearly the method of use and it obviates the chance of error in cutting screw threads. It will be found that the diameter and the thread pitch, as well as the standard, are marked on the gauge as well as on the taps and dies, so that the use of corresponding tools will give parts that are interchangeable. Taps come in three general forms—that is, taps for machine work such as we are dealing with. The forms are illustrated in Fig. 15. No. 1 is a starting tap, tapered at the end so that it will start easily; No. 2 is used for holes that go all the way through and follows No. 1 in the work; while No. 3 is used for “blind” holes, not going all the way through, but which it is desirable to thread to the very bottom. The use of the tap with the tap wrench or holder is made plain by reference to Fig. 16. Three points are to be

borne in mind: hold the tap perpendicular to the work; advance the thread just a little bit and withdraw the tap a turn or two to clear it of chips; use plenty of lard oil for the work. In short, smooth, true threads are easily cut by

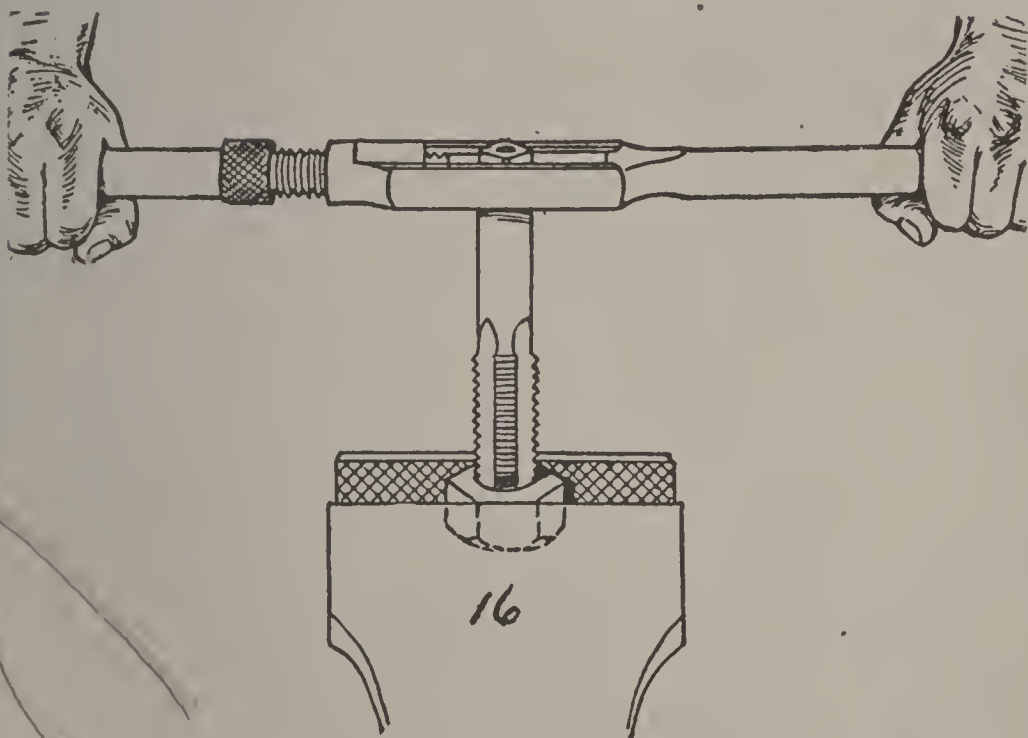


Fig. 16. Tapping
with tap and die
wrench.

starting the tap with care and not forcing it too fast..

The dies, which are also manipulated by means of a wrench, commonly called a "stock," also come in two forms—adjustable and non-adjustable. They are manipulated in the same manner as the taps, and the same precautions should be observed.

In Fig. 18 is illustrated a good machinist's square and a ground arbor, which form a very handy complement for the tool kit; in the illustration they are employed in determining alignment of the connecting rod bearings. However, they can be used to equal advantage for many

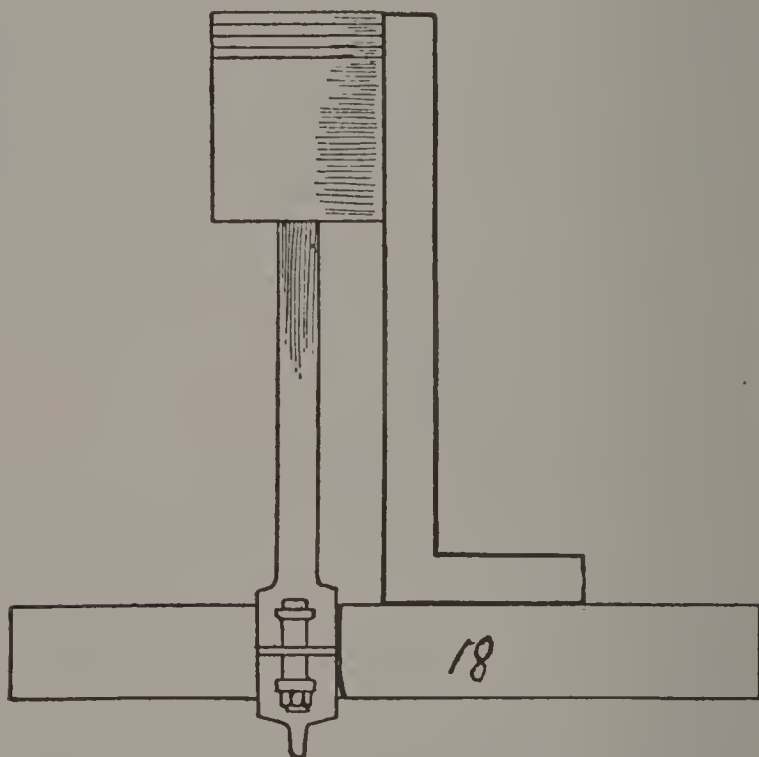


Fig. 18. Use of square and ground arbor.

similar purposes. Another useful tool is the dividers, shown in Fig. 19, on following page.

A set of good reamers for enlarging and smoothing out holes that have been drilled or otherwise formed, and leaving them in perfect shape and to exact size for bearing use is desirable. They come tapered, straight and expanding in various sizes, and are used with a tap wrench in much the same manner as the tap.

The entire equipment of the repair shop should be systematically checked up every night. The tools may be kept on silhouette boards such as are used in the laboratory, or may be packed carefully in tool chests. If the former method is used it will be immediately noted if any tools are missing, but, if kept in chests, a list of the tools in each chest should be pasted in the cover and the tools checked against it as they are put away. Make sure that all tools are reasonably clean before they are packed, but do not remove all the oil or grease, as a thin film will protect them against rust. See that all edge tools, such as scrapers, etc., are protected, and that the files are in a safe place.

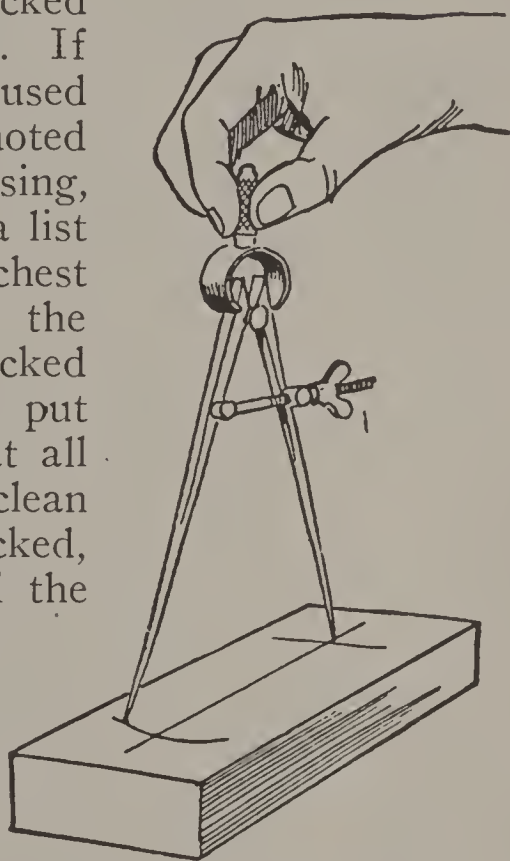


Fig. 19. Use of dividers.

BATTERY SERVICE AS A BUSINESS

Some Thoughts on the Equipment of a Modern Station — Its Arrangement — Hints and Suggestions

THE universal adoption of electric lighting and starting for automobiles has opened a field of business little thought of a few years ago, but which has grown to amazing proportions.

The sale, care and repair of automobile batteries and starting and lighting systems is now a business in itself and offers splendid opportunities to those who go into it fully equipped with a knowledge of the business and on an adequate scale. It is essential that those who go into the business with a view of meeting success understand the construction and operation of storage batteries and that the shop they undertake to manage be well equipped to repair storage batteries.

This chapter has for its purpose the suggestion of the equipment that is necessary for a fully equipped battery service station, with some thoughts on the most convenient arrangement of the room or rooms employed for battery service work.

The following tools and apparatus will be found convenient in repairing starting and lighting batteries, as well as storage batteries used on electric automobiles :

1 pair rubber gloves to protect the hands of the workman from the battery acid.

1 pair 7-inch end-cutting pliers, for pulling elements and work of similar nature.

2 pairs of ordinary combination pliers, for pulling elements and similar work.

1 triangular lead scraper, such as plumbers use for scraping burning lead, plate lugs, etc.

1 putty knife, for removing sealing compound.

1 $\frac{1}{2}$ -inch wood chisel, for removing sealing compound.

1 5-inch screwdriver, for removing sealing compound and battery cell covers.

1 single end wrench for removing taper terminals.

1 10-inch coarse file with handle, for filing lead, plate lugs, etc.

1 steel wire brush, for cleaning terminals, etc.

1 small ball point hammer (machinists' hammer), for general work.

1 10-inch ratchet brace, for drilling connecting links loose from pillar posts.

1 $\frac{5}{8}$ -inch bit stock drill, for removing $\frac{5}{8}$ -inch connectors.

1 $\frac{7}{8}$ -inch bit stock drill, for removing $\frac{7}{8}$ -inch connectors.

1 center punch, for centering terminals before drilling.

1 adjustable hack saw frame, for general work.

Supply of hack saw blades, 8-inch.

1 iron ladle, for pouring sealing compound.

1 pair blue glasses, for use when operating burning outfit.

1 soft rubber bulb syringe, for flushing and equalizing electrolyte.

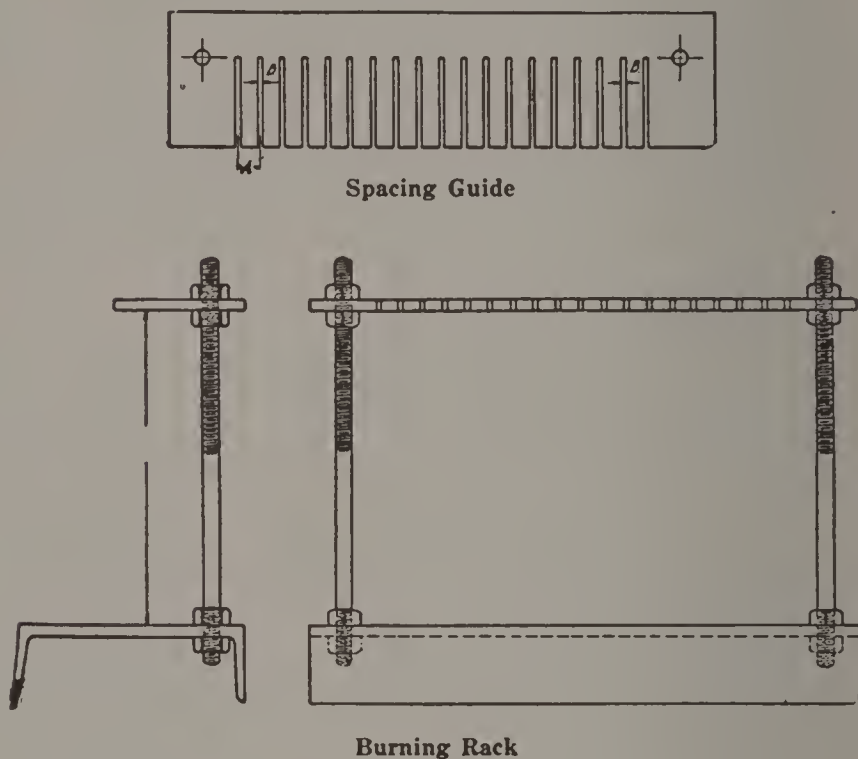


Fig. 1.

1 steel file brush, for cleaning lead parts and file.

1 burning rack with extra guides, for holding plates and connecting straps in place while burning.

1 hydrometer, for mixing electrolyte.

1 thermometer, for determining the temperature of the cells, or the electrolyte, etc.

1 lead burning outfit.

1 automatic water still, for purifying water for use in producing electrolyte.

Suitable battery charging apparatus to meet the conditions.

The lead-burning rack is shown in Figure 1. It is adjustable as to height and can be supplied with guides having proper spacing for all batteries manufactured. These guides are furnished as follows: $7/16''$, $3/8''$, $3/4''$, $19/32''$, $5/8''$.

Lead burning consists of fusing component parts of the battery together by the use of a hot flame or a white-hot carbon pencil. The most widely used outfits using a flame are as follows:

Illuminating gas and compressed air. This flame is identical with that produced by the ordinary Bunsen burner and is not a wholly satisfactory flame for lead-burning work.

Hydrogen gas and compressed air. Where hydrogen can be procured in tanks, this is found to be a very satisfactory outfit, as it produces a hotter flame than one of the illuminating gas with compressed air, and where a great amount of work is to be done its use saves considerable time.

Oxygen and illuminating gas. This is the most satisfactory combination, inasmuch as no compressed air is required and commercial oxygen can be obtained practically throughout the United States. It is also very much more economical than hydrogen and air. At the same time

the oxygen can be utilized for burning the carbon from the cylinders of engines. It is illustrated in Figure 2.

Oxygen gas and hydrogen gas. This combination is not as economical as oxygen with illu-

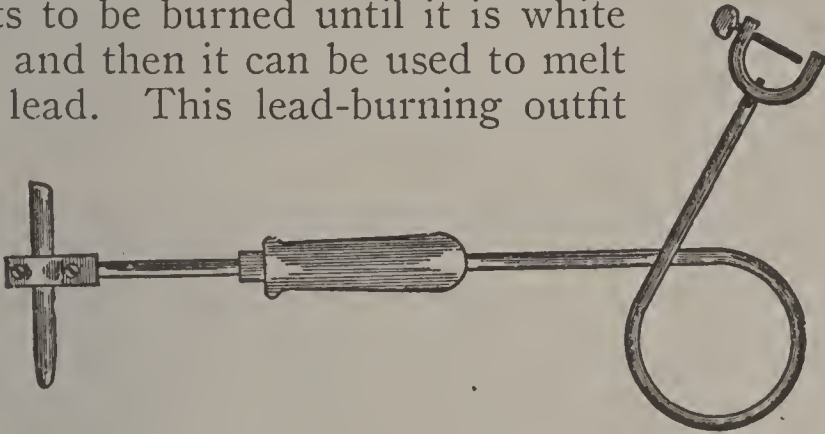


Fig. 2. Oxygen-illuminating gas lead burning outfit.

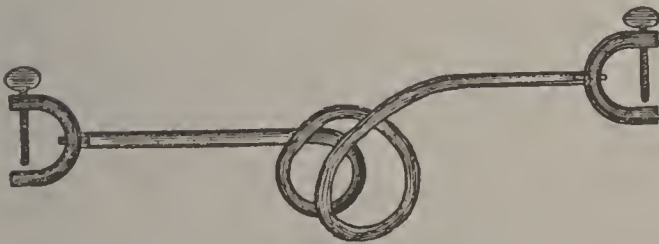
minating gas, and the flame produced is so much hotter that it is not wholly suitable for the work in hand.

For minor repairs, a cheap and useful outfit is the arc burning outfit. The current for this out-

fit is supplied by the battery being repaired, or by the use of the extension shown in Figure 3 the current from one or more other batteries can be utilized. The carbon pencil shown in the illustration is allowed to rest on parts to be burned until it is white hot, and then it can be used to melt the lead. This lead-burning outfit



Arc Burning Outfit



Extension

Fig. 3.

can be obtained from almost any battery manufacturer.

The use of distilled water in connection with storage batteries is a matter of vital importance, because it means prolonged battery life and greater efficiency. There is scarcely a natural water supply that is totally free from impurities

which are highly injurious to storage batteries, and the constant application of such water to the cells will result, in a comparatively short time, of concentration of impurities in sufficient quantity to prove distinctly injurious to the battery elements.

The Rochlitz water still, shown in Figure 4, is adapted to remove iron, chlorine, nitrates and other impurities from the water. Iron causes a tendency for internal short-circuit and self-discharge of batteries; chlorine and nitrates cause disintegration of the positive plates. Therefore, to avoid these injuries and bring the electrolyte to the proper density, pure distilled water only should be used for flushing and washing.

The device is absolutely automatic in operation, adapted to keep a sufficient supply of treated water on hand at all times, and is provided with burners to adapt it for several different varieties of fuel. It costs from 1/10 of a cent to 2 cents a gallon to treat the water used for storage batteries with this apparatus.

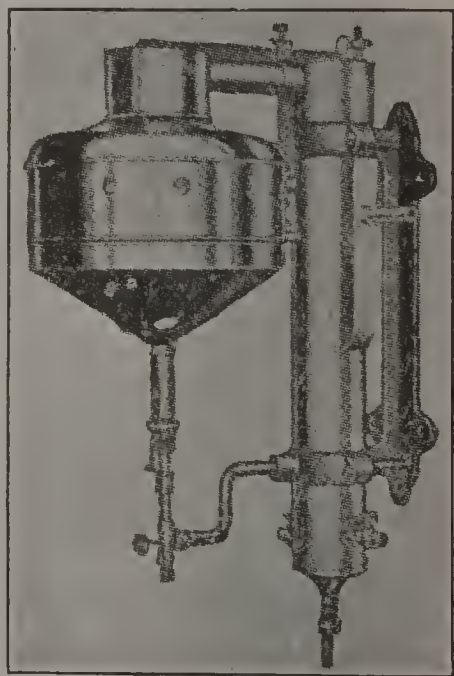


Fig. 4. Using artificial or natural gas, distilled water costs approximately 2 cents per gallon, figuring gas at \$1 per thousand cubic feet.

Storage batteries must be charged from direct current. If only alternating current is available,

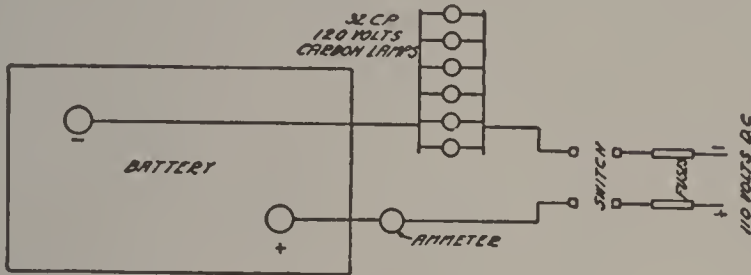


FIG. 5 CHARGING THROUGH BANKS OF LAMPS ON 110 VOLT CIRCUIT.

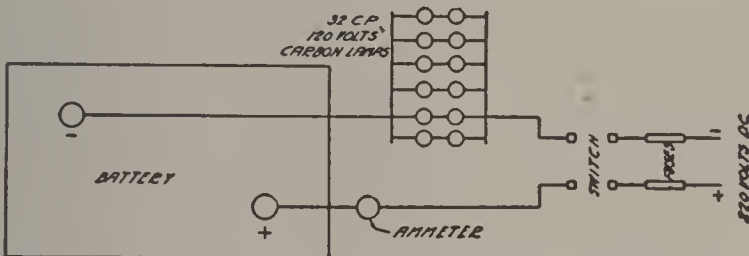


FIG. 6 CHARGING THROUGH BANKS OF LAMPS ON 220 VOLT CIRCUIT—IN THIS CASE TWO LAMPS ARE USED IN SERIES

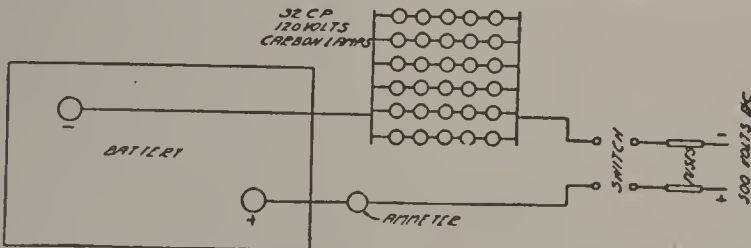


FIG. 7 CHARGING THROUGH BANKS OF LAMPS ON 500 VOLT CIRCUIT—IN THIS CASE FIVE LAMPS ARE USED IN SERIES

this must be converted to direct current by a rectifier or motor generator set.

Where direct current is available it is usually of high voltage compared to the voltage of an automobile starting and lighting battery, and apparatus must be used to obtain the proper voltage across the battery terminals unless a considerable amount of charging can be done in series.

The insertion of a bank of lamps between the source of supply and the battery (Figures 5, 6, 7) is lowest in first cost, but is an uneconomical method of charging—especially for a large battery service station.

The proper lamps to use are 32-candlepower, 120-volt carbon filament lamps. These will permit a current of about one ampere per lamp, so that the number of lamps in parallel will determine the charging current.

If desired, the bank of lamps may be replaced by a rheostat (Figure 8). While no more economical, this method is more convenient than the lamp bank, as it is necessary only to turn the handle of the rheostat to obtain the charging current desired.

When charging either through a bank of lamps or through a rheostat, batteries of about the same capacity should be charged in series (Figure 9), rather than in parallel (Figure 10).

Note that although the same current is going through the batteries in Figures 9 and 10, twice as much current is coming from the charging source in Figure 10 as in Figure 9. This means that half the current consumed is going to waste.

In charging a number of batteries in series, the charging rate should be that of the battery of the lowest capacity.

The methods of charging before mentioned are uneconomical, unless a considerable number of cells, 20 to 40, on 110 volts can be charged in

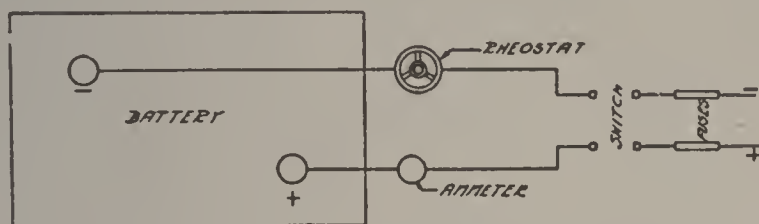


FIG. 8 CHARGING THROUGH RHEOSTAT

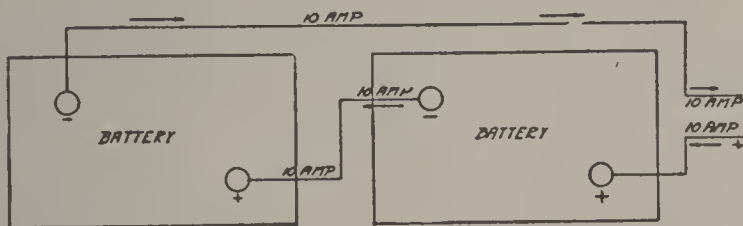


FIG. 9 CHARGING TWO BATTERIES IN SERIES

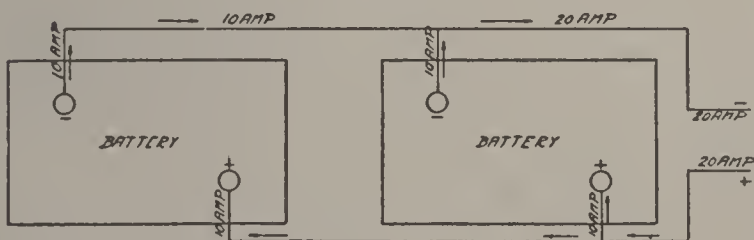


FIG. 10 CHARGING TWO BATTERIES IN PARALLEL.

series at one time, as otherwise the greater proportion of the current, is lost in the resistance.

Under ordinary conditions it will be found best to install a motor generator set to transform the current to the proper charging voltage.

When alternating current only is available it must be transformed to direct current for charging, either by the use of an A. C. rectifier or a motor generator set, preferably the latter. In ordering such a set, the maker must be told the voltage of the current available, the frequency or cycle, and whether single or three-phase, and the number of six-volt batteries to be charged at one time.

Batteries brought to a service station to be charged are usually completely discharged and oftentimes have been allowed to remain in a discharged condition long enough to collect considerable hard sulphate on the plates. For this reason it is well to charge the battery at a very low rate in order to bring it back to normal and that it may receive a full charge. On the following page is given the initial and final rates recommended for Gould starting and lighting batteries.

The initial rate may be continued for five hours, and then the charging current should be lowered to the final rate and continued at this rate until the battery is fully charged.

If, while charging at the initial rate, the cells commence to gas freely, the charging current should be lowered to the final rate. If the temperature rises to 110° F., the charge should be discontinued until the temperature falls to 100° F., then continued at the final rate.

The charge at the final rate should be continued until the cell voltage and the specific

TYPES	6 Volts	8 Volts	12 Volts	16 Volts	18 Volts	24 Volts	30 Volts	— Amperes —	
								Initial	Final
ASL, ASLR.....	625	....	1225	....	....	2425	3025	5	2½
AEL, AELR.....	645	....	1245	....	....	2445	....	7	3½
ACH, ACHR.....	663	....	1263	....	....	....	....	10	5
ALG	681	....	1281	....	....	....	....	13	6½
	699	....	....	....	....	....	....	16	8
	615	....	....	....	....	....	....	18	9
	632	....	....	....	....	....	....	21	10½
BSL, BEL.....	620	820	1220	1620	1820	2420	3020	4	2
BSH, BEH.....	635	835	1235	1635	1835	2435	....	6	3
BML, BHG.....	650	850	1250	1650	1850	2450	....	9	4½
BSPH, BSLP.....	670	870	1270	1670	1870	....	....	11	5½
	695	895	....	....	....	....	....	13	6½
	610	810	....	....	....	....	....	16	8
	655	....	....	....	....	....	....	21	10½
BSHH, BEHH.....	....	....	1280	....	....	....	....	13	6½
	610	....	....	....	....	....	....	16	8
	630	....	....	....	....	....	....	20	10
	675	....	....	....	....	....	....	23	11½
ES, EE.....	678	....	....	....	....	....	....	13	6½
ESI, EEJ.....	692	....	....	....	....	....	....	15	7½
ESK, EEK.....	635	....	....	....	....	....	....	21	10½
F.....	614	....	....	....	....	....	....	18	9
G. GMV.....	616	....	....	....	....	....	....	18	9
I.....	....	....	....	....	....	2413	....	2	1

gravity of the electrolyte have remained constant for 5 hours.

Using the foregoing formula an empty battery should be fully charged in approximately 15 hours.

If it is desired to charge a battery of a make other than shown in the Gould table, use the charging rate of the Gould battery that replaces the one that it is desired to charge. It would be impossible to give a complete line-up of all makes and models with their respective charging rates.

Be careful that the positive pole of the battery is connected to the positive pole of the charging circuit. If there is no voltmeter of sufficient range to read the polarity of the charging circuit, this polarity may be determined as follows:

Mix a teaspoonful of salt in a glass of water. Insert the ends of the leads from the charging circuit in the water. Bubbles will be given off the negative lead.

The vent caps should be removed from the batteries while being charged.

Even up the electrolyte to the 1.300 specific gravity by adding 1.400 acid if the electrolyte is low and by adding pure water if the electrolyte is high at the end of the charging period.

Screw the vent caps tightly into place and clean the battery top with ammoniated water. Grease the terminals with vaseline or heavy grease.

When a battery is brought to the station for storage it should first be tested carefully.

If the battery is six months old or less, and the test shows it to be in good condition, it should

be fully charged, filled to the proper height, and the electrolyte should be evened up to 1.300. Thereafter it should be charged, if possible, every month, and at least once every two months, at the final rate given in the table. This freshening charge need only be for two or three hours until the cells gas freely or the gravity reaches 1.270 to 1.280.

When the battery is to go into service it should be charged at the final rate given in the table until the specific gravity of the electrolyte and the voltage of the battery remain constant for a period of five hours. The solution should be brought to the proper height and the gravity of the electrolyte to 1.300.

If the battery is over six months old and is to be stored for an indefinite time or for a period of from three to four months, the user should be notified that in all probability the battery will need new separators shortly after it goes into service and that it would be advisable to have the battery stored dry and have new separators installed just before he wishes to use the battery.

The battery should be fully charged as per instructions above. The elements should be removed and the wood separators discarded. Also discard the old electrolyte.

Soak the positive and negative groups in cold water for at least 15 minutes. Positive groups can then be laid aside to dry. The negative groups will probably heat when removed from the water, and they should be redipped until they cool off. The parts can now be stored in a dry

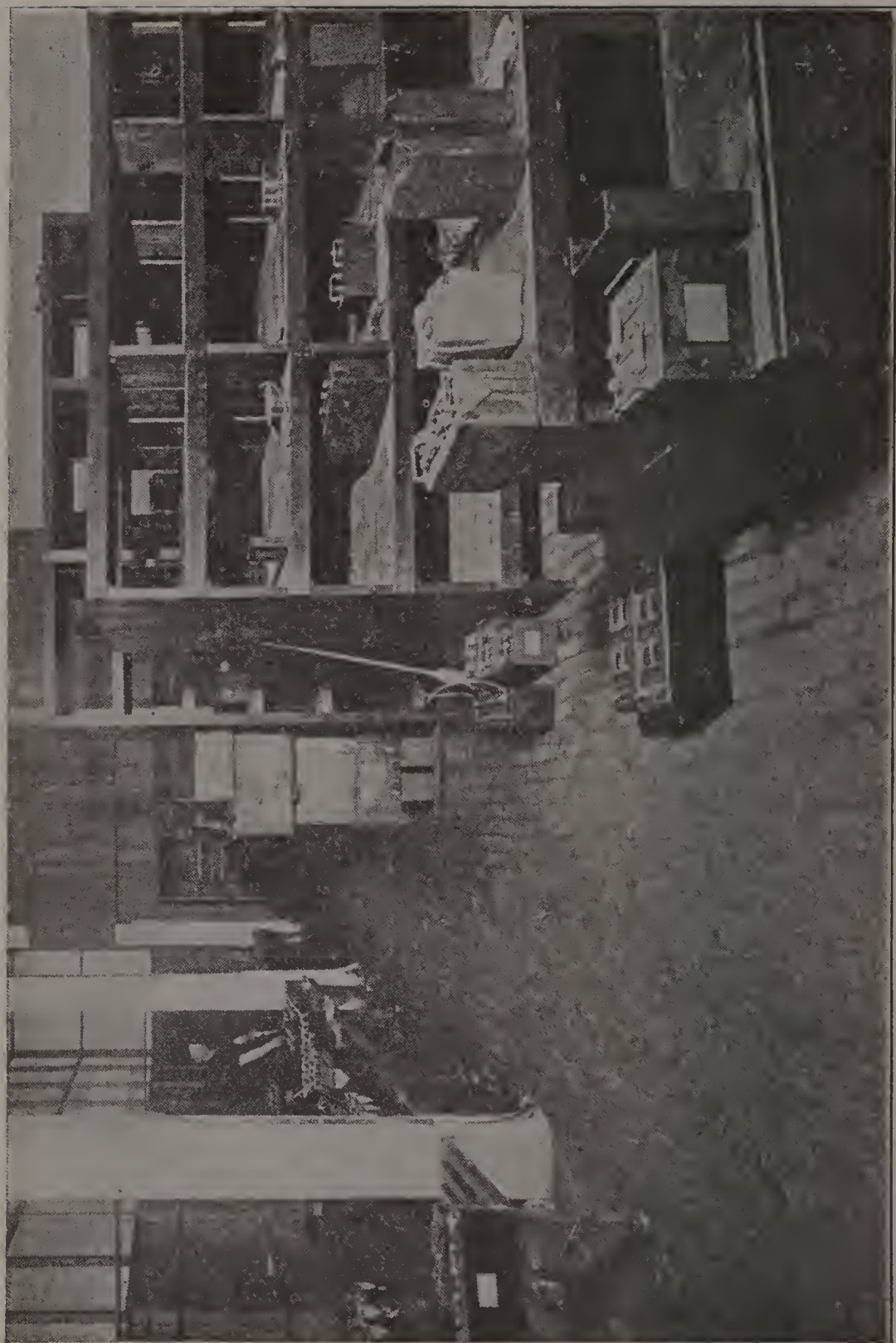


Fig. 11. A typical battery and stockroom, showing arrangement of shelving and charging benches.

place, care being taken not to let the positive and negative groups come in contact.

When the battery is reassembled, the electrolyte placed in the cells should have an initial density of 1.300.

New batteries carried in stock should be given an occasional freshening charge, recommended for batteries in storage.

Terminals and terminal connections of stock batteries should be well greased to prevent corrosion.

A sufficient number of shelves should be provided for batteries carried in stock. On account of their weight, the shelving should be built of about two-inch lumber and partitioned off to insure solidity and to facilitate the location of the various sizes of batteries. (Figure 11.) It is good practice to designate the type, and number with white chalk on the side of the battery exposed. A space should be left between batteries for ventilation. At regular intervals batteries should be tested with a hydrometer, and if found low in specific gravity they must be removed to the charging table and given a boosting charge. This is vitally important.

For the purpose of stocking wood cases, rubber jars, plate groups and plates the battery shelves can be utilized. If it is desired to build special shelves, they need not be constructed of as heavy lumber as the battery shelves.

Such parts as connector links, terminals, straps and jar covers should be kept in a rack of bins.

Bins eight inches square will take care of the average requirements. A sufficient number of bins should be provided to take care of the average assortment of parts carried in stock. It is a simple matter to increase the capacity whenever necessary. Each bin should be marked to identify the part it contains.

Service stations doing an extensive repair business should adopt a system of identifying batteries taken in for repairs. This can be accomplished by providing a board with a number of hooks for metal tags. Each tag should be numbered and its position on the board designated by a corresponding number. When a battery is received for repairs a metal tag should be attached to it and a paper tag containing the name of the owner and other necessary information placed on the hook from which the metal tag was taken. The number on the metal tag attached to the battery will serve to identify the owner. If it is desired to separate the usable parts, they can be placed in a bin bearing the same number as that of the metal tag.

The charging table should be built substantially and of sufficient size to take care of all ordinary requirements. Its location in the battery room (Figure 12) should be arranged so that it will be readily accessible to the charging source.

The best place for the repairman's bench is up against one of the walls of the battery room. The apparatus for lead burning should be near by. All the equipment necessary for the repairman should be conveniently arranged on the bench. In addi-

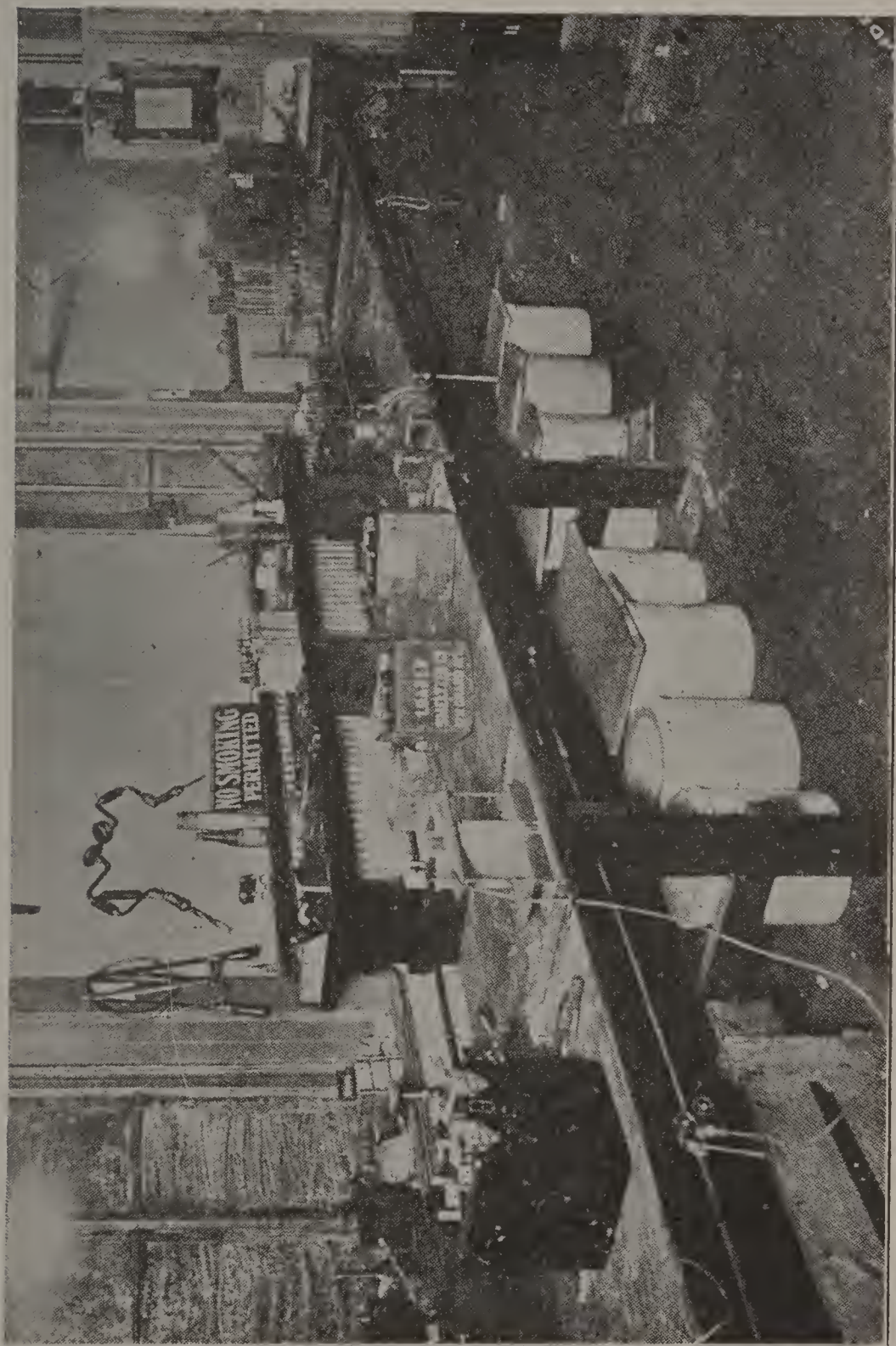


Fig. 12. Battery workroom. The two lines of pipe running along the work-table carry hydrogen and air for lead burning. Separators of various sizes are carried in the large crocks below the table. The "paper cutter" at extreme right of the table is for cutting separators to special sizes.

tion to tools, this equipment should include a single-burner gas range and an iron kettle for heating sealing compound and a ladle for pouring compound.

It is of vital importance that separators be kept moist in order that they may be serviceable when needed. This may be accomplished by immersion in water to which has been added a small amount of sulphuric acid. Only enough acid should be added to the water to give it a sour taste. The mixture of acid will keep the separators sweet and prevent the fungus growth and scum usually present when pure water only is used.

Stone jars varying in capacity from 10 to 25 gallons, to contain the solution, will be found best for the average service station requirements. Such jars can be obtained at a reasonable cost and should be equipped with a close-fitting wood cover provided with a handle for convenience in removing. The separators should be tied in bundles and submerged in the jars.

Wooden tanks may also be used, but are not as serviceable as the stone jars.

Separators may also be kept in condition by sprinkling them with water at regular intervals; keeping them submerged, however, is by far the most satisfactory method.

BATTERY STUDY FOR SERVICE MEN

High Lights on the Construction, Operation, Inspection and Care of Storage Cells

STORAGE batteries for automobile starting and lighting consist of three or more cells, depending upon the voltage required. Each cell has an electric pressure of about two volts, so that a battery of three cells is known as a six-volt battery. One of six cells is known as a 12-volt battery, etc.

The plates are constructed of grids of hard antimonious lead (Figure 2), in which are pasted what is known as the active material, which is the material which undergoes chemical change when the battery is charged or discharged. After this active material is pasted into the grids the plates are formed electro-chemically, the active material on the positive plate becoming oxide of lead and on the negative plate becoming pure spongy lead.

After the positive plates have been formed they are built into groups (Figures 3 and 4), which consist of one or more positive plates burned to a connecting strap to form the positive group, and two or more negative plates burned to a connecting strap to form the negative group. To each strap is attached a post, which is used to make electrical connections between the group and an adjoining group or to the starting and lighting system.

An element consists of a positive and negative group, the negative group always having at least one more plate than the positive group. Thus a

three-plate element would have one positive plate and two negative plates; a fine-plate element would have two positive and three negative plates, etc.

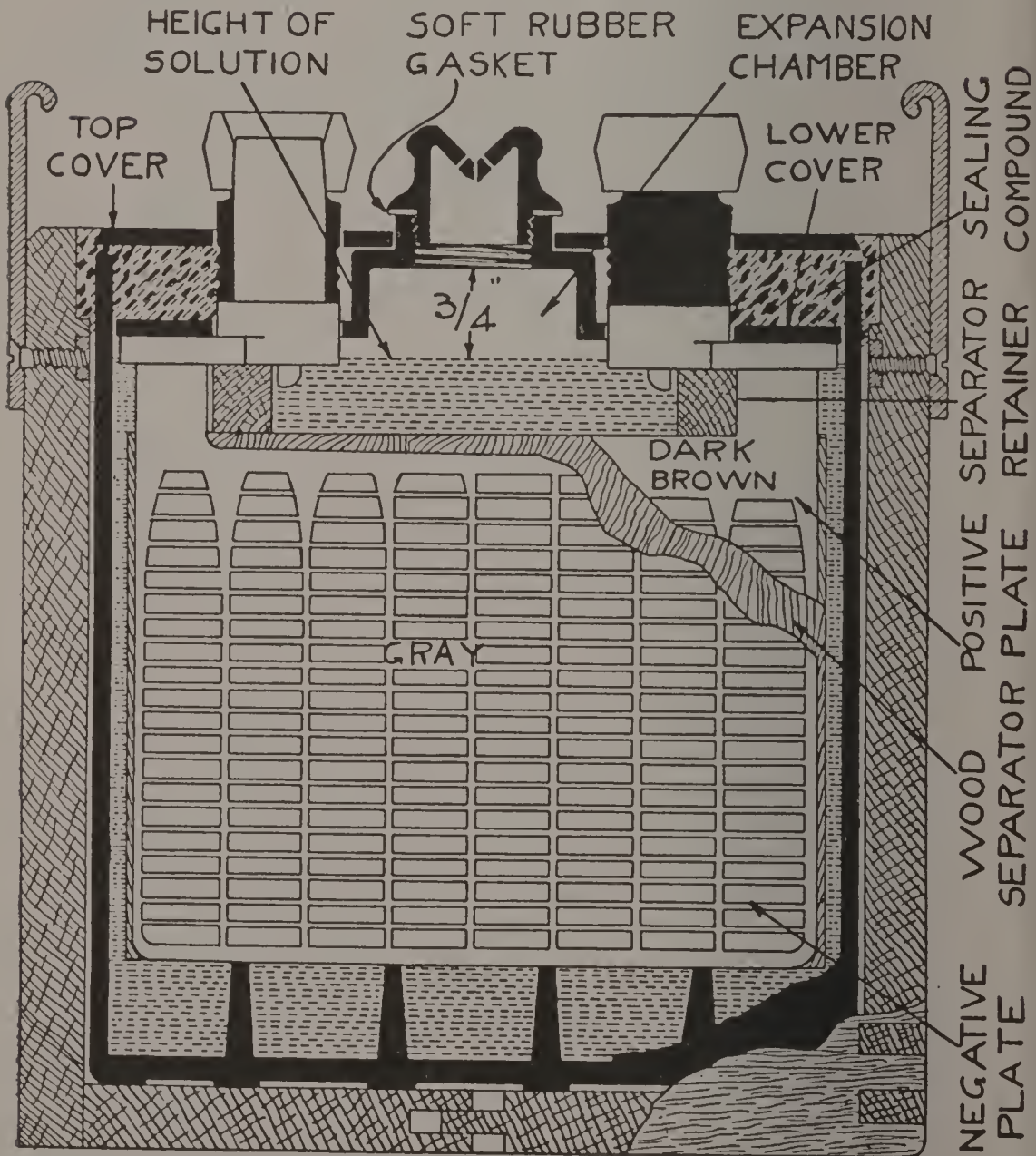


Fig. 1. Parts of battery enumerated.

The plates are so burned to the connecting straps that when the element is assembled each positive plate surface is adjacent to a negative plate surface, the distance between these surfaces

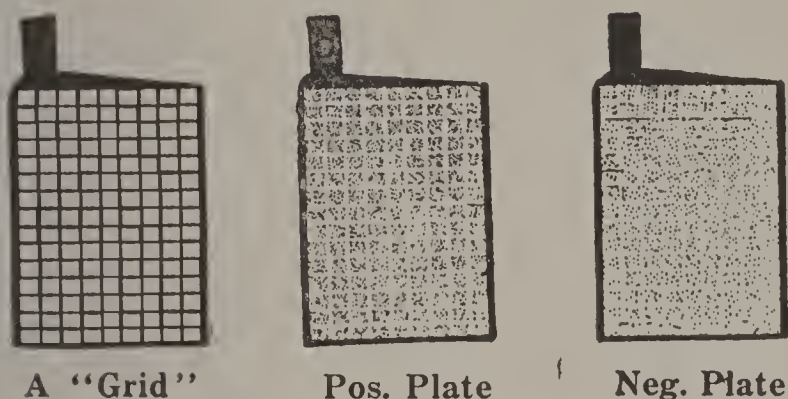


Fig. 2. Plates in detail.

being from $\frac{3}{32}$ " to $\frac{1}{8}$ ". The positive and negative surfaces are kept apart by wood or rubber sheets known as separators.

A five-plate element would thus consist of negative plate, separator, positive plate, separator, negative plate, separator, positive plate, separator, negative plate.

The electrolyte or liquid consists of a mixture of sulphuric acid and pure water. The proportion is about one part of acid to three parts of water. The proportion of water and acid is such that the density of the solution will read 1.300 on the hydrometer at 70 degrees F.

The jar in which the elements are contained is of hard rubber, and on its bottom are raised sections or ridges on which the element rests, leaving space in the bottom of the jar for any active material that may shed from the plates.

The cover is of hard rubber with an opening in the center, with a vent cap and an opening on each side for the connecting posts on the positive and negative groups, which are known as terminals.

A complete cell consists of the rubber jar, the element in the jar resting on the ridges, the electrolyte covering the element, and the cover, which is carefully sealed in the jar with sealing compound.

The complete battery consists of the desired number of cells assembled in a wooden case, the cells being connected together in accordance with the requirements of the starting and lighting system with which it is to be used.

When the cell is fully charged the electrolyte has a density or specific gravity of 1.300. The active material on the positive plates being oxide of lead, and on the negative plates pure spongy lead. The pressure between the positive and negative groups is about two volts, and if these groups are connected together through an electrical conductor, such as an electric lamp or a motor, current will flow between them and discharge the cell. During this discharge, a chemical action takes place which converts the lead oxide on the positive plates and the pure spongy lead on the negative plates both to sulphate of lead. This chemical change removes sulphur from the acid, thereby lowering the specific gravity or density of the solution. When the cell is completely discharged its density is about 1.150.

When current is sent through the cell in an opposite or charging direction, a chemical action

occurs precisely the reverse of that under discharge. The action of the charging current removes the sulphur from the plates, changing the lead sulphate on the positive plates back to lead oxide and on the negative plates to pure spongy lead. Inasmuch as the sulphur returns to the solution, this solution becomes more dense, and when the cell is fully charged the solution reaches its original density of 1.300.

As above stated, the charging current changes the plates back to their original chemical formation, and when the element is completely charged the charging current can do no more useful work; its only effect under fully charged conditions is to convert particles of water in the electrolyte to hydrogen and oxygen gas, which bubble up violently and indicate that the battery is at or near a full state of charge.

These gases are also formed in the plates, the oxygen gas in the positive plate and the hydrogen gas in the negative plate, and there is a tendency for the oxygen mechanically to force the lead oxide from the positive plate. This condition is one that is often met with on automobile starting and lighting systems which are necessarily set to



Connecting Strap



Separator

Fig. 3. Other components.

overcharge the battery rather than to undercharge it.

For this reason the plates must be particularly rugged, and the usual plate is designed to receive heavy and frequent overcharging with practically no ill-effects.

If the element does not receive sufficient charge, the sulphate is apt to harden to such an

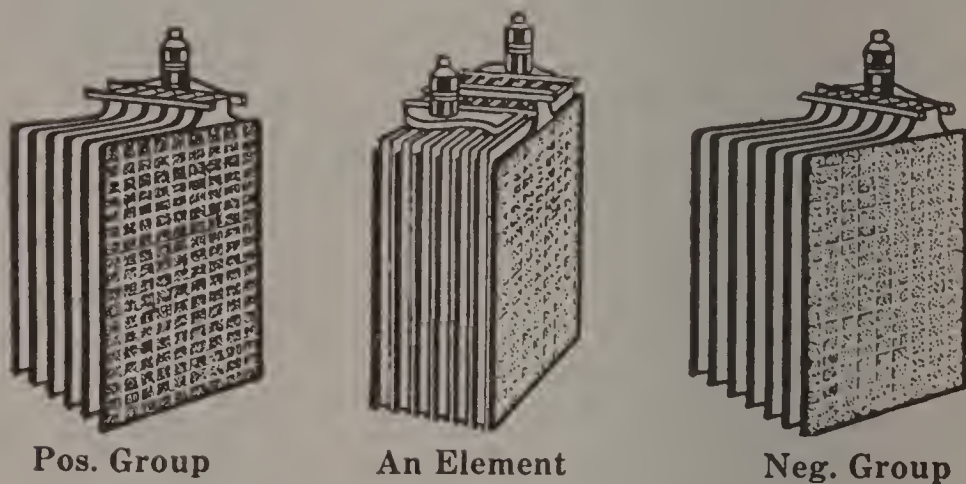


Fig. 4. How plates are assembled.

extent as to be very difficult to remove from the plates. Furthermore, if the battery is allowed to remain in an uncharged condition, a dense, hard sulphate will form on the plates, which is even more difficult to remove. This happens to a lesser extent even when the battery is fully charged. It is, therefore, advisable to charge the battery immediately after a discharge and about once a month, when idle, even though fully charged.

When the element is charged or discharged, the chemical reactions due to the passage of

the current through the electrolyte cause heat to be formed. This heat does not become injurious until the temperature rises to about 105 degrees F.; and it can rise to 110 degrees F., or even higher, for brief periods of time without injury. It is, however, not considered advisable to charge a battery for any length of time after its temperature has risen to the first-mentioned maximum. The battery should then be taken off charge and allowed to cool.

Due to heat formed on charge and discharge, and also due to gasing on overcharge, the water in the solution evaporates, and as the sulphuric acid does not evaporate, the solution becomes more dense. This evaporation must, therefore, be made up by pure water only.

The amount of evaporation will depend on the temperature and upon the amount of work done by the battery, and is, therefore, a varying quantity. But a safe rule to follow is to replace the water lost by evaporation every week in summer and every two weeks in winter.

Starting and lighting batteries are shipped in containers with triangular tops and with "This Side Up" instructions to the carrier. These precautions are taken to prevent leakage of the solution through the vents, due to the battery resting on its top or sides. A further precaution is by sealing the vent caps with soft rubber nipples. When returning a battery to the manufacturer or to a distributor, care should be taken to see that it is packed carefully in a container as above described.

On receipt of the battery, it should be wiped clean of dust and particles of packing material, and the nipples on the vents should be discarded. The case should be carefully examined, and if there is evidence of damage in transit, claims should immediately be made against the carrier.

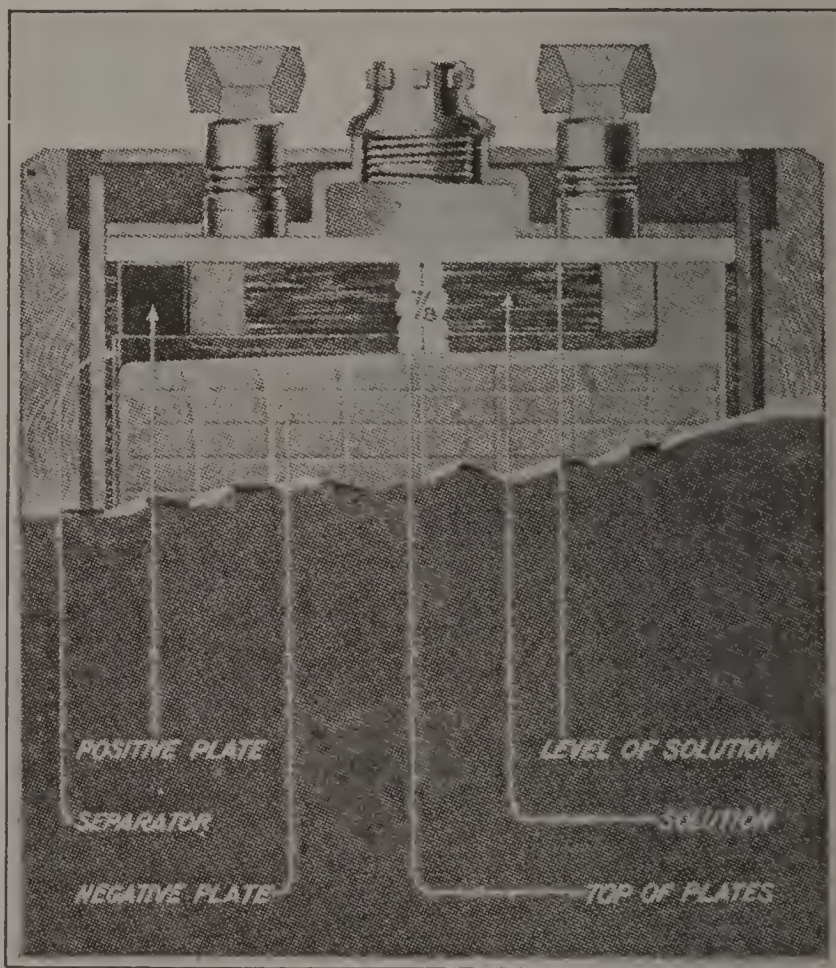


Fig. 5. Proper height for solution.

Remove the vent caps from the cells and determine the height of solution in each cell, which should be the height shown in Figure 5. If this is the case, there is no indication of a leaky jar.

Every battery shipped is brought to full charge and the acid density of each cell is adjusted before it leaves the factory. The battery is also given a severe test for leaks in order to preclude the possibility of the shipment of a leaky battery.

Test the solution in each cell with a hydrometer testing set as outlined later, and then adjust the height of the solution; distilled water, rain water or melted artificial ice only should be used for this adjustment. In a new battery the density of the solution in the cells should read 1.275 to 1.300, or somewhat less, depending upon the elapsed time since the battery left the factory, temperature conditions, etc.

If the density of the solution reads below 1.250 the battery should be given a "freshening" charge until the hydrometer reads 1.300 in each cell. The proper charging rates are given in books covering individual makes. Care should be taken to charge in the proper direction; the positive terminal of the battery should be connected to the positive side of the charging system.

Replace the vent caps, screwing them in tightly, and place the battery on a clean, dry spot for 24 hours as an extra test for a leaky jar, and note whether there is any dampness under the battery.

The foregoing instructions for inspection of a new battery apply equally to one that has been in service. The latter, however, may have been subjected to various abuses, or it may be worn out.

Most battery service stations offer to their customers a regular inspection of their batteries without charge.

Such free inspection covers testing with the hydrometer and filling with distilled water, and is designed to insure to the customer satisfactory life from his battery; but not to cover cost of repairs. On the basis that an ounce of prevention is worth a pound of cure, troubles caught at the start can soon be remedied. The following instructions should enable the service man to get to the seat of any trouble that may exist:

The instruments generally used for testing starting and lighting batteries are the hydrometer set, the voltmeter and the ammeter. The one indispensable instrument for testing a storage

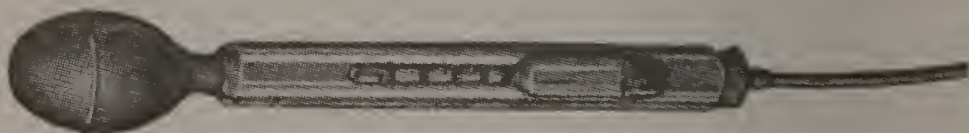


Fig. 6. Hydrometer test set.

battery is the hydrometer set (Figure 6). This set consists of a hydrometer within a syringe, and is used to determine the specific gravity of the solution in the cell.

The solution consists of sulphuric acid diluted with water. Taking the density of water as 1.000, the density of the solution in a fully charged battery will be 1.300. As the battery becomes discharged this density gradually decreases until the battery is fully discharged, when the density will be 1.150. The state of charge of the battery can, therefore, be determined with great exactness by the density of the solution.

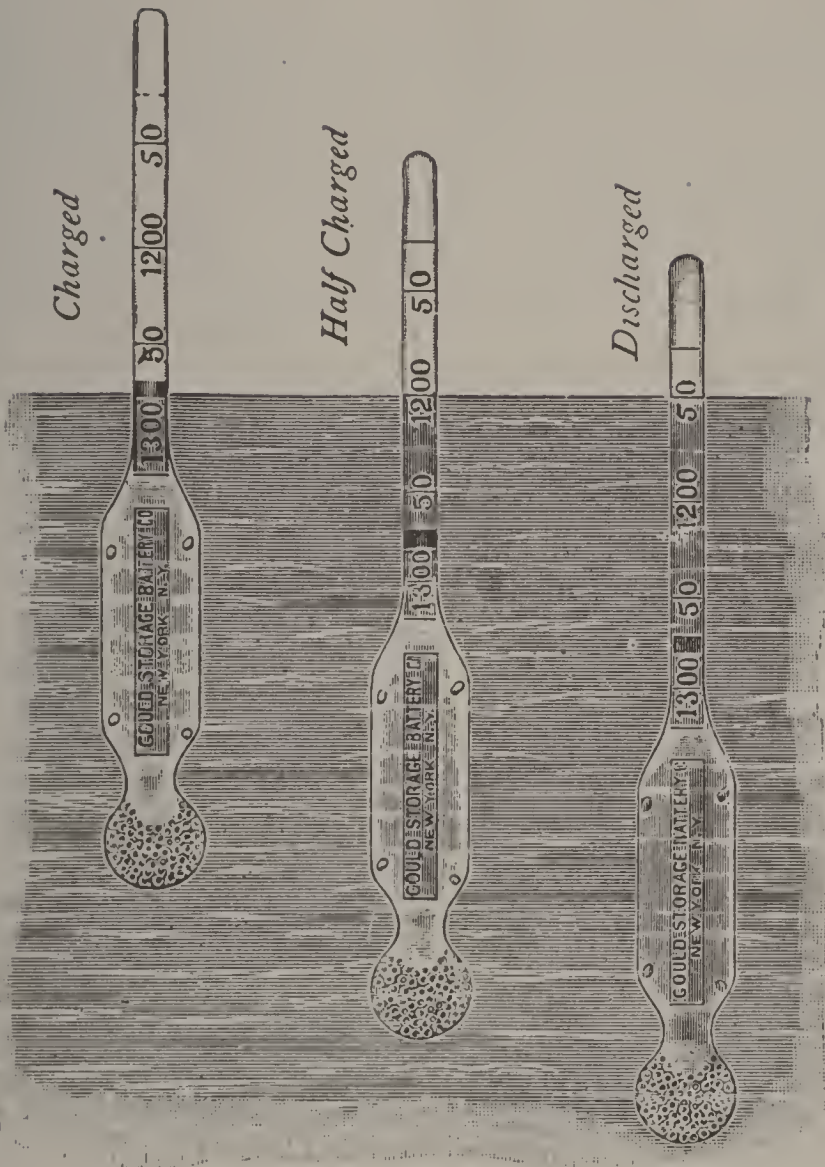


Fig. 7. Cut showing state of charge of cell as indicated by the density of the solution.

These densities are at 70 degrees F., and will change slightly with changes in temperature. The variation, however, is so small that it may be, and generally is, disregarded.

Remove the vent cap from the cell, squeeze the rubber bulb, and then insert the rubber tube

in the cell well below the surface of the solution. Then slowly release the rubber bulb, drawing the solution into the glass chamber until the hydrometer floats freely. Note the point at which the hydrometer stem emerges from the solution. This point indicates the density thereof, and, therefore, the state of charge of the cell. Test each cell of the battery in this manner.

Then slowly withdraw the tube from the solution and squeeze the bulb to return the solution in the hydrometer set to the cell. For the convenience of the user, the Gould hydrometer has a red band around the stem. When the cell is fully charged, the red band is at the level of the solution. It will be noted (Figure 7) that the position of the hydrometer showing the cell discharged is at a point a little higher than 1.150. The reason for this is that it is not considered advisable to allow the cell to reach a completely discharged condition, and it should be recharged when the hydrometer reading is from 1.170 to 1.180.

It may be well to emphasize at this point that the hydrometer reading should always be taken before water is added to the cell. The water, being lighter than the electrolyte, will tend to remain on top thereof, and therefore a hydrometer reading taken after the water is added and before it is thoroughly mixed would not be correct.

The chief use of the volmeter is to determine the positive and negative terminals of the cells and the individual cell voltage on charge and discharge. A convenient scale is from 0 to 15

volts. The leads should be equipped with sharp prods.

Press the prods into the terminals of each cell until a good connection is made. When the voltmeter reads in the right direction, the terminal of the cell connected with the voltmeter lead from the connection marked (+) is the positive terminal. The positive terminal of one cell should be connected to the negative terminal of the next cell. If not, the cells are not assembled correctly in the battery case and they should be reassembled.

A fully charged cell should read from 2.5 to 2.6 volts, depending on the age of the battery and while charging current is flowing through battery. It should read about 1.8 volts when nearly discharged and when battery is discharging at a current of about five amperes. When a cell is floating—that is, neither charging or discharging—the voltage should be about 2.1.

The ammeter is used to determine the amount of current flowing through the battery on charge and discharge. In the station the ammeter enables the operator to charge at the proper rate and also to make capacity test on discharge.

When used in testing a battery on a car, it should be connected directly to the battery to avoid the escape of current through grounds, etc., before going through the meter. Never connect an ammeter directly across terminals of a storage battery, as a short-circuit will result, which may ruin the instrument.

PROFITS IN VULCANIZING

How the Tire Repairman or Garage Operator, Having a Vulcanizing Department, May Extend His Field

UNTIL somebody invents a tire that is not susceptible to tread cuts and punctures, the field of the vulcanizer and general tire repairer is bound to be extended. Realizing this, and appreciating the fact that there is good profit in a volume of repair work, there is a growing tendency among garage owners to install a vulcanizing department.

Most public garages have space enough for at least a small repair section and vulcanizing plant. This takes but little room and its requirements are comparatively few.

The market affords a fairly wide selection of vulcanizing and auxiliary machines, by far the most popular at present being those operated by steam, generated either in a boiler or from a gasoline burner. For those who prefer them, there are electric vulcanizers for both tires and tubes, which operate on either alternating or direct current.

At the outset it should be remembered that while vulcanizing in the tire repair business tends constantly to become an all-year-round trade, it has more or less seasonal limitations in its present stage of development; that is, nearly every vulcanizer learns that there are dull periods, when little business in this precise line is coming in, so that the more far-seeing ones usually have

a side line, such as battery repair and recharging, a general automotive equipment stock, or a moderate-sized stock of tires and tubes.

The sales from these sources usually more than offset any business hesitation in vulcanizing and tire repair.

But the garage owner who has a tire repair department seldom has to do much contriving to make the department a success. Such a section,



Table for cutting down and building tires. Note the mandrels at side and front for supporting tires in work. The top is protected from marring and cement stains by a sheet iron overlay.

of course, has little or no "overhead," and most modern public garages nowadays carry at least some general automotive equipment for sale. The problem of supporting a vulcanizing department, with the exception of the labor question, there-

fore, is about half-solved for the garageman when he starts it. He has his customers almost "ready-made," and if he instructs his night manager to inspect carefully each night his customers' cars, particularly their tires, and report on them next morning, the customers usually are amenable to timely suggestions as to the money and time that can be saved for them through prompt tire repairs.



Separate building-up and cementing tables.

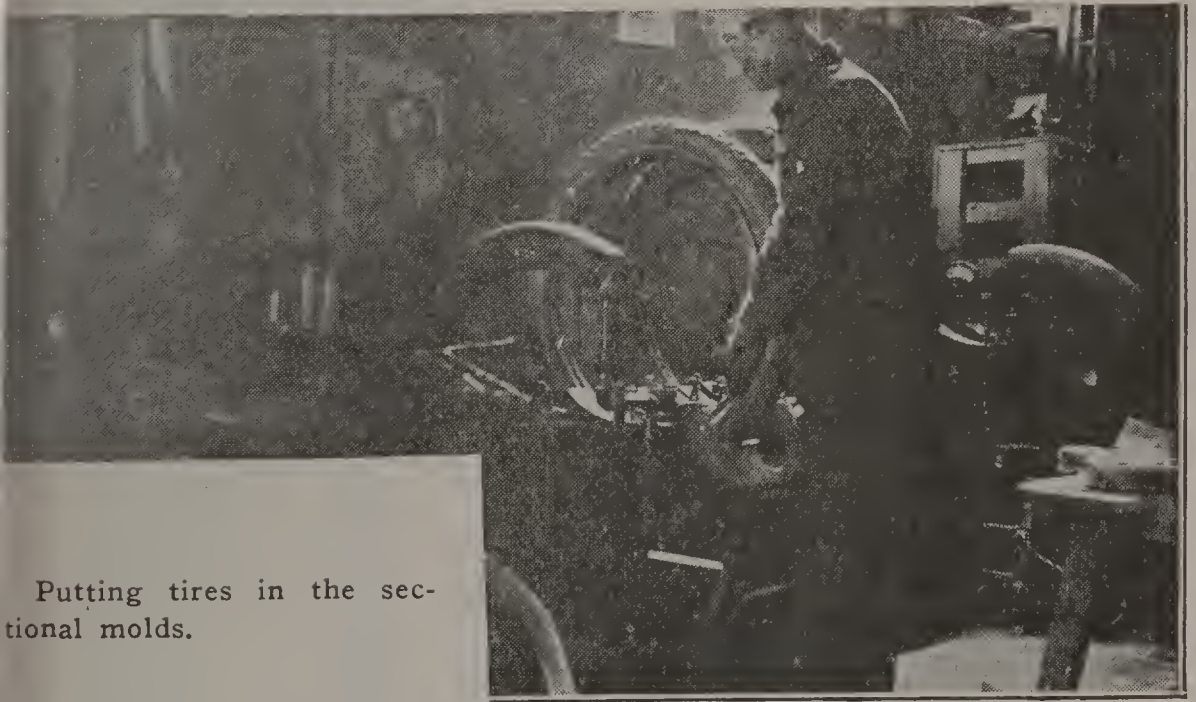
Of course, tire repair experts differ as to the exact nature of the processes and equipment necessary to get the best results; but nearly all of them have a common ground for making ordinary repairs. Such repairs come under the following general divisions:

1. *Tread cuts.* Though slight at first, if these are neglected they become large and deep, resulting in blow-outs sooner or later.

2. *Chain cuts.* These result from improperly adjusted tire chains.

3. *Punctures,* from tacks, glass and other sharp-pointed or sharp-edged things.

4. *Wear.* This may come unduly from use of tires while under-inflated, from too sudden application of brakes, or from wheels out of alignment.

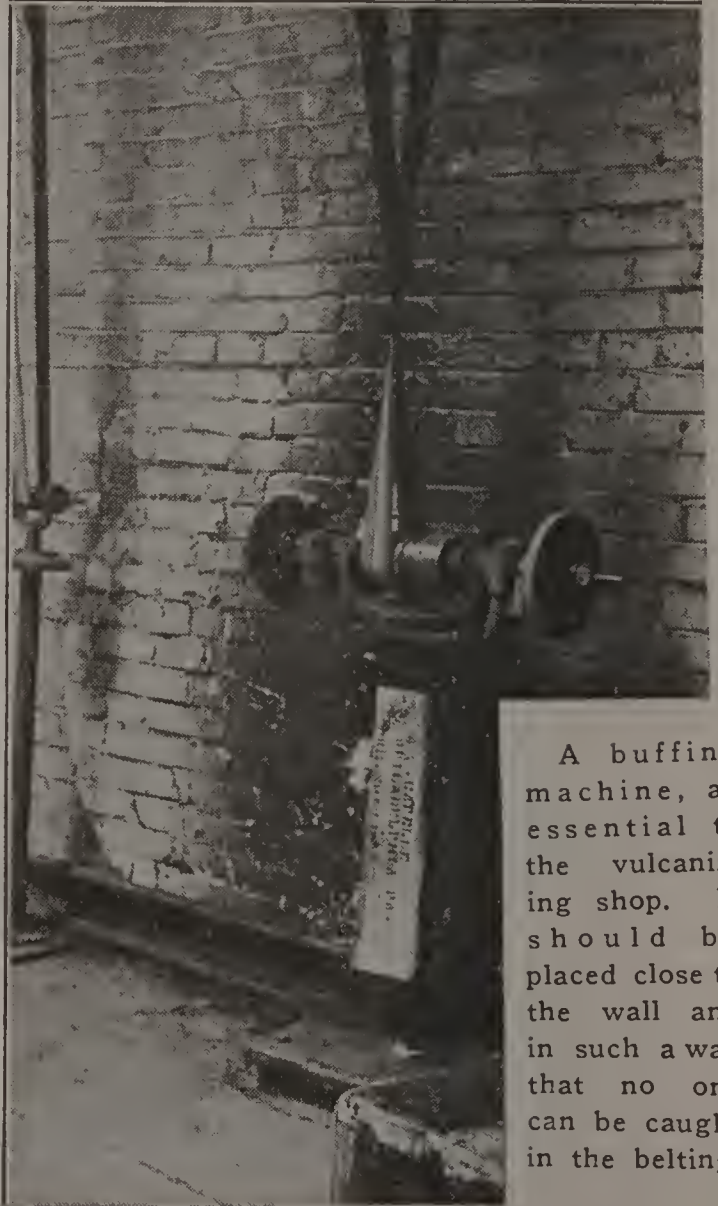


Putting tires in the sectional molds.

Even sand-blisters and small bruises require attention, as their neglect will soon cause deterioration of the immediate tire area, followed eventually by blow-outs and loose treads.

What, by common consent, is proper equipment for taking care of all these difficulties, and

others in addition, includes: Cutting-down and building-up table; cementing stand; material rack; tube-testing tank; work benches (the number, of course, depends on the size of the force assigned to this department, as each workman should have a bench), provided with drawers that lock, an electrically run buffing wheel; a re-areader; sectional relining molds; a tube plate; a tire spreader; a tread roller; a tube deflator; an air compressor; a tread bank for sections of treads to be matched; several air or sand bags and enough wall hooks



A buffing machine, an essential to the vulcanizing shop. It should be placed close to the wall and in such a way that no one can be caught in the belting.

to keep the tires not in work off the floor. Each bench for the workmen should be equipped with "elbows," or mandrels, on which to suspend tubes and tires in work. The cutting—down and building-up table — sometimes it is well to have separate tables for each of these processes — should have a metal overlay, preferably sheet iron or zinc, to prevent marring and staining.

Ordinarily the tire repairman will find the commonest jobs with which he has to deal will consist of the following general types: Retreading, relining, sectional work, reinforcing, repairing tread sections only, mending bead sections, patching cord tire punctures, repairing tubes in various ways, including patching; and replacing old pads with new, putting in new splices and putting in new valves.

The tire repairman who goes after new business often has his workmen instructed to be on the lookout for passenger cars and trucks whose tires show wear—no matter whose they are. By obtaining the license number of the cars, or by other means, it is comparatively easy to learn the name and address of each owner. Then these owners should either be circularized, or a personal letter — by far the better method — should be typed to each, telling concisely what can be done in the way of tire repairs and showing how good service and prompt mending will prolong the life of a tire and save the owner money.

Thus hitting the car owner "where he lives"—in the pocketbook—is apt to bring results, provided the letter is business-like.

The preparation and distribution of well-phrased business letters, telling what the tire repairman can do to fill the needs of customers, is the most direct means of obtaining results next to a personal interview, and indeed, frequently leads thereto. The next best publicity is through newspaper advertising. Dodgers and the like usually are found wanting in the long run. Calendars, blotters, and anything more or less permanent, or that will remain on the car owner's desk in plain sight for a reasonable period, are a fair medium. But every vulcanizer and garage owner having a tire repair department should at least do seasonal advertising, if not continuous.

Here are the specifications—rather hard to obtain—for a table, work bench and accessory equipment suitable for a medium-sized vulcanizing shop, a photograph of the cutting and building table accompanying this article:

TABLE FOR CUTTING AND BUILDING.

Six—4 x 4 in. x 12 ft.....	posts
Two—1½ x 10 in. x 4 ft.....	skirting
Two—1½ x 10 in. x 12 ft.	
Two—32 x 6 in. x 5 ft.....	Mandrel supports
Four—1½ x 10 in. x 4 ft.....	drawer slides
Four—1 x 2 in. x 4 ft.	
Four—2 x 4 in. x 10 ft.....	posts
Two—2 x 4 in. x 4 ft., 6 in.....	ledgers
Three—1 x 4 in. x 4 ft., 6 in.....	arms
50 ft. B. M. T. & G. flooring table top.	
Two—drawers 6 in. x 1 ft., 10 in. x 1 ft., 10 in.	

TABLE FOR STRIPPING AND CEMENTING.

Four pieces 4x 4 in. x 3 ft.....	posts
Two—1½ x 10 in. x 4 ft.....	skirting
Two—1½ x 10 in. x 8 ft.	

Two—1½ x 10 in. x 4 ft.....drawer slides
 One—1 x 2 in. x 4 ft.
 40 ft. B. M. T. & G. flooring.
 One—2 x 6 in. x 5 ft.....mandrel support
 One—6 in. x 1 ft., 10 in. x 1 ft.....drawer

WORK TABLES (2) EACH.

Four pieces—4 x 4 in. x 3 ft., 1 in.....posts
 Six—2 x 6 in. x 3 ft., 6 in.....ledgers
 Six—2 x 4 in. x 3 ft., 6 in.....braces
 Six—2 x 8 in. x 4 ft.....top
 15 ft. B. M. T. & G. flooring, bottom shelf.

TIRE RACK.

Four—2 x 4 in. x 12 ft.....plates
 Ten—2 x 4 in. x 10 ft.....posts
 Sixteen—2 x 4 in. x 2 ft., 10 in.....rails
 Thirty-two—1 x 4 in. x 1 ft.....braces

SHELVES.

Two—1 x 10 in. x 6 ft.
 Two—1 x 10 in. x 3 ft.
 Two—1 x 10 in. x 1 ft., 6 in.

While the foregoing may not mean much to the layman, it may prove of considerable value to the vulcanizer and tire repairman who wishes to have his tables, racks and shelves made to order. Any carpenter will understand just what is desired from the above specifications. A tire repairman cannot always find new or second-hand equipment of this kind, especially in the smaller towns.

The addition of a battery recharging and repair department, or a department for the sale of automotive equipment, oils and greases, spark plugs, and new and second-hand tires is, as al-

ready mentioned, something usually desirable, but a problem each garageman and vulcanizer must "feel out" for himself. Generally a vulcanizer can afford to start such a department after having been in business a year or two; if he has capital available and a good location where custom is promising, he would do well to risk starting in with a small stock of tires and equipment, as well as soliciting some battery agency. The owner of the public garage ordinarily can put in such a department at once, to very good advantage, for, as already pointed out, he has his custom "ready-made" to a certain extent.

Here are a few of the articles a battery repair department should be supplied with: Recharging system, Edison base resistance, branding irons both positive and negative, as well as neutral; steel stamps, positive and negative; hydrometer syringe for measuring the specific gravity or density of the fluid in the battery cell, which is called electrolyte; battery thermometer, portable voltmeter for reading battery, or cell voltage; connector removers; wrenches, putty knives, screwdriver, spanner bits, several pairs of pliers; compounding material jars, stock of spare battery parts, finger pipe with six tips; burning lead molds, separator cutters, polarity indicators, pillar post builders, cone trimmers, reamers, burnishing brushes and connector pullers.

POINTS TO OBSERVE IN STARTING A TIRE AND REPAIR SHOP

Too Often Some of These Suggestions Are Overlooked

THESE are the foundations of a successful retail tire business. A suitable store location; good merchandising sense; a nominal amount of capital; ability to visualize what can be accomplished by "going after it," and—especially if the tire merchant is just starting out, or has a small shop—the determination to be accommodating to customers in small things as well as in large.

Personal solicitation of trade, with its opportunities for getting into close touch with customers and their affairs, has proved particularly effective from a dollars-and-cents viewpoint for the small shop tire dealer engaged in what might be termed a "neighborhood business." It is also productive of good results where contract work is being sought among owners of delivery truck fleets, whether they are department store proprietors or express line operators. There is a tendency among even the smallest tire retailers to conduct a tire servicing station and repair shop as an adjunct of the business, and there are many cases wherein this end of it has become the major one. There is also a noticeable trend toward selling and caring for both pneumatic and solid tires.

It is all very well to talk about the prevalence of pneumatics, but any tire concern that has a

solid tire press usually is kept busy pressing off and on tires.

Soliciting in person in the vicinity of a shop in a rural or suburban section is usually a simple problem of the tire dealer's going after the trade that is on hand, whenever he can find time to make his calls. Once having obtained that custom it is up to him to retain it, and being accommodating in little things is one of the surest ways to clinch it, experience has shown. Arousing and nurturing good will is an important factor in a "neighborhood" business, and the more personal interest the tire dealer takes in his customers, their families and friends, their motoring plans and their vacations, the easier his business path is apt to be — provided he can accomplish this tactfully.

Accommodation that welds a dealer's customers to him may come about from the simplest of services—so simple, in fact, as to be almost absurd; and yet the results have proved these advances worth while. For instance, a tire dealer and vulcanizer who repaired a hot water bottle for a customer as a favor, and also with a sagacious view of getting into closer touch with some of the family's friends whose tire repair business he wanted, was able to satisfy this desire. Finally he placed a small card in his window offering to perform this service for a nominal sum. He sold many tires through this unusual step.

Another tire dealer and vulcanizer repaired as an accommodation, the tires of a boy neighbor's bicycle and the tires of another neighbor's baby carriage. Soon he had special departments de-

voted to these branches, in addition to his regular line of trade, which greatly increased. While there may not be much revenue in these side issues, especially at the start, the adroit dealer can turn them all to good account and make them stepping stones to extended custom. In small accommodations, after all, lies the strength of the small shop in any line.

Getting Truck Tire Business

It is not only possible, but advisable, for the tire dealer having a "neighborhood" business as a basis, to go after the business of selling and servicing truck tires. Especially desirable are contracts for equipping and servicing truck fleets—with this proviso: After getting the business do not let free service use up too much time, for some truck drivers appear to think that a contract is a license to demand all the working hours of a tire concern on their fleet alone.

A sharp line of demarcation should be drawn and adhered to, on what demands compensation and what is "policy" work. To the tire dealer and repairman who is first on the job, or who succeeds in convincing, in spite of keen competition, that his shop is the best fitted for doing the work for fleets, this field generally opens the way to steady work and fair profits. Some men increase their business by advertising for this fleet work, but in the beginning it is almost never obtained by mere advertising. "Go-getter" methods are necessary.

Sometimes the dealer has the opportunity of "growing up" with his fleet-owning custom, getting the work as fast as new vehicles are added.

Most stambers of commerce, or boards of trade, are glad to supply information relative to concerns just starting in business, and it is often worth while for the small tire dealer to join such an organization. But there are, of course, various ways of obtaining new prospects, including paying a fee and being supplied with the state registration of motor car owners. Where past work has been unsatisfactory, many established houses operating delivery cars are glad to change to a new concern equipped to take care of its tires, so a first refusal from a concern need not always be taken as final. Some dealers gain many prospects by periodically "pounding away" at concerns which have at first turned them down. It is good policy to learn the names of the various traffic managers in town, so they may be regularly canvassed for tires and repairs.

Where Tractor Tires are Profitable

Because of stringent new road laws in many states, it is necessary in these localities for individuals and concerns operating tractors over public highways, to prevent damage thereto by equipping their tractors with rubber tires, or wheel bands of some kind or other. Usually rubber tires are insisted upon. This phase of automotive equipment is undergoing considerable development and special tires for tractors now are being made in blocks, or sections, which it pays tire dealers in farming communities to handle.

Then, too, since Henry Ford started to push the Fordson, making it compulsory for his car dealers to accept an allotment; since the great popularity of other small forms of tractor, including the Cle-trac, such automotive vehicles are being increasingly utilized for industrial purposes, such as hauling iron about factory yards; taking away ashes and cinders; and in making excavations for buildings. This permits some city tire dealers to handle tractor tires profitably. As these tires ordinarily are in solid sections, the repair problem is little or nothing; it usually means only the renewal of a section.

Systematic Solicitation Best

In handling passenger car and truck tires, best solicitation results usually come from dividing the town into zones and making a certain number of calls within each zone in a given period, until the town has been thoroughly canvassed. Haphazard solicitation is apt to prove discouraging, especially to an inexperienced solicitor, because of the large successive number of "turn-downs" likely to occur in some localities.

Some tire dealers and repairmen have considerable success with solicitation of the business of independent garages and service stations, specializing along this line and having one or two salesmen to call constantly on this trade. While few small tire shops can afford it, those that have already "arrived" find a towing service car an especially well appreciated accommodation and a first-class advertisement, particularly when

the name, address, telephone number and brands of tires handled appear conspicuously on the car.

One Pennsylvania tire dealer has a special wrecking service car which he drives about his town, and along roads where there is much motor traffic. At dangerous intersections and hidden curves, he appears once or twice every night, with an illuminated electric sign on his car, upon which is mounted a chain hoist and other useful wrecking apparatus; but this is edging over on the general service station province and few tire dealers would care to do it, although this dealer and repairman reaps considerable of a harvest in this way.

Follow-up letters are an important adjunct to the tire dealer's business. Usually these are compiled for him by his distributor, and sometimes by the factory, which sells him the stationery, with his own letterhead, at cost. Often a list of "leads," or good prospects, is supplied, and about all the dealer has to do in this case is to pay the stationery bill and the postage and address the envelopes. Any distributor, or factory, will be glad to supply envelope inserts and other advertising matter to include with the letters.

Using a Tire News Service

Some tire factories supply a tire news service, whereby the tire dealer may train his salesmen, this constituting a really valuable "correspondence school" course, which relieves the busy dealer from calling staff meetings to instruct his men. All the shop proprietor has to do is

to distribute the news leaflets among his force for their absorption.

For instance, the following news sheet is instructive alike to salesman and prospect:

“TIRE NEWS SERVICE.

“Bang!

“The motorist stops his car and disgustedly gets out to examine the blow-out. To his amazement the tire has not gone flat and the tread is still intact. Technically this trouble is known as a ‘gum blow-out.’ Pocketed air in the side wall, caused by an obstructed puncture, simply reached the bursting point and exploded.

“The facts of the case are, that a puncture is often partially sealed by the tread, so that air escapes very slowly. It may be that a nail, still imbedded in the tread, assists in corking up the hole.

“A slow tube leak results and air seeps through the fabric, according to tire repairmen. This air is imprisoned between the tread and fabric.

“Each revolution of the tire acts like a force pump on this pocketed air, forcing it further and further from under the tread towards the side wall. Here it forms a blister, similar to a mud boil.

“When the blister breaks, due to excessive pressure, a ragged hole is torn in the side wall rubber. Although the tear does not go through the fabric, it will result in serious

damage to the carcass if it is long exposed to the road.

“When a blister is noticed on the side wall, take the casing to a tire surgeon without delay.”

What the salesman learns from the news service, so-called, he passes along to his customer.

Join an Automobile Club or So

Many alert tire dealers make a point of joining an automobile club or so, with the always attractive list of prospects as a goal. Tourist trade easily is obtained in this way by the man who keeps his eyes open and who is in touch with “sociability runs” and the like. Lists of likely prospects often are obtained from friendly road-house proprietors and the managers of oil filling stations representing the larger oil companies. Now and then a car dealer likes to have on his list a good tire dealer and repairman, to whom he can refer his “overflow” trade.

Seasonal postcards, mailed to prospects, often prove helpful in reminding them of their needs and of the stock carried by the dealer. This plan can be extended also to vulcanizing and general repairs. Almost every car owner in these post-war days of economy needs to have vulcanizing done from time to time, and the tire dealer who can afford it, should purchase vulcanizing equipment and devote a small portion of his shop to its installation.

There is a form which a factory supplies in quantity to its dealers, which is a sample letter

to be filled in on the copy with the names of local satisfied customers, on request of the dealer, who writes on the back of the form information to be used in making up his special letterhead. The factory sends these letters out to an appended list of car owner prospects.

This is the form in which the information is supplied to the factory by the dealer on the back of the return form letter, so the factory may compile the letter to the dealer's prospects:

"GENTLEMEN :

"Please write me a letter like this to send to the list of car owners attached.

"It is understood all I pay is the postage.

"Signature

"In addition give following information for letterheads:

"Firm Name

"Phone.....

"Address

"City

"State"

Almost any factory would do this on request.

Factories Supply Signs

Factories, sometimes direct, and sometimes through distributors, are accustomed to supplying various kinds of signs—road, show window and door—for the use of dealers. The dealer usually finds some sort of newspaper advertising, either display, or "liners," profitable and most dealers use both as soon as they can afford it.

The various kinds of tire stock should be segregated to avoid confusion, and properly tagged. Tubes for the various sizes of shoes should be kept near each kind, the box being plainly marked. The lighter tires should be arranged upright in racks, easily accessible, and where tires are piled, the best practice is not to pile them more than twenty-five units high, as the bottom tires are apt to be pressed out of shape if there are too many tires to the pile. An approved way of piling tires is "two down and one on top of them," in layers, this permitting the greatest number in the smallest area.

Solid tires can be piled horizontally, or stood up, without harm to their shape.

Caring for the Accessory Stocks

Most tire dealers have found that it pays to keep at least a small stock of automotive equipment in the usual assortment of accessories. These should be kept in an orderly manner in tagged or labeled bins, or in shelved compartments. The car owner who has to buy a tire, or get one repaired, if he sees accessories is almost sure to be reminded of some of his needs in this line.

Tire dealers who carry a stock of any considerable size should keep a "perpetual inventory." An inventory form of this kind, whereby close track is kept of all tire stocks, so that the amount on hand may be told at any moment, as well as the number sold, is reproduced herewith.

This record is kept in a loose-leaf binder and one can see at a glance what sizes of each type

of tire are in stock—for instance, such as cord, fabric, geared-to-the-road, and ribbed tread, the type being written or typed above the size on the upper right-hand corner of the form. I conveys knowledge of what is needed, as well as what is on hand. The stock is tagged against size and type, and there is a separate sheet for every size and type of tire carried. It is thus easy to tell what stocks are being disposed of most rapidly and what are slow-moving. The dealer can be governed accordingly in placing orders. By keeping such a record, the necessity for having a very large stock constantly on hand is obviated and by watching the record closely, any stock can be prevented from running too low.

VARIOUS WAYS OF ADVERTISING THE GARAGE

EVEN the garage operator in the very small town has learned the value of publicity and no longer permits his business to jog along without seeking trade actively “because everyone here knows where my place is.”

The live garageman is after tourist and all kinds of transient trade—folk that don't have any idea “where the old place is” unless he takes pains to attract them to it, or unless they stumble on it. In the latter case the garageman probably has a good “strategic” location.

The first thing the garageman in a small town should do, when he has decided to tell the world that he is in business, is to reflect:

(a) Whom do I wish to reach with my publicity?

(b) What are my facilities for serving my customers?

(c) What is the best way for me to get my message "across" to them?

(d) Just what sort of publicity shall I use to advertise my business?

There is usually comprehended in the small town garage business, as mentioned in previous articles, the dealer in automobiles, trucks and tractors, the salesman of automotive equipment and tires, parts, oils and greases and department devoted to servicing any or all of the motor vehicles handled.

Indeed, keeping a garage in a small town may be much more complex than conducting one in a big city, with few departments.

Studying the first question which the small town garageman should ask himself, namely, whom do I wish to reach with my publicity? there come, of course, first into his mind the various types of vehicles he may be handling, representing different kinds of users. For instance, there will be the prosperous owner of the passenger car who lives in the town proper; the storekeeper who uses a light delivery car for his business and probably a small car for his family outings; the professional man, like the doctor; the baggage transfer company, and, best customer of all, as is being rapidly realized, the farmer, who nowadays is apt to possess a passenger car, at least one motor truck and a tractor.

It is an easy matter for the garageman to select the newspaper which is to carry his message to most of these prospects or customers. Very likely he will use all the newspapers published in the town, and if he is wise he will advertise also in that newspaper, which, careful scrutiny shows him, has the biggest county circulation—very likely the one that has the contract to do the “county printing.”

The importance of the farmer to the garageman's business is being accentuated in many localities by direct appeal in advertising and by a painstaking effort to show the farmer just what can be done for him by the garageman-dealer in the way of service. This seems to be the only kind of prospect that the small town garageman is making such an effort to attract specifically. General publicity ordinarily is regarded as sufficient for bringing in the other classes of trade. Now and then a country garageman will try to make his place of business a sort of community center, supplanting the corner grocer with his cheery corner for the gossips; but as a usual thing the garageman wants just as few loungers around his place of business—owing to its nature—as he can have without giving positive offense in keeping them away.

Illustrative of the “community center” idea for garagemen, a Coudersport, Pa., garage firm offers to pay the highest price in cash for eggs and poultry!

If the firm wishes this sort of thing, it is rather good advertising, for it serves the purpose and attracts trade. Accommodation and service

are two words the small town garageman has got to have in his mind and be ready to act on the suggestions contained therein.

Having decided just whom he wants to reach with his message, the garageman would do well to take stock of his facilities, so that he cannot be caught unawares, or turn away a disappointed prospect, or even an old customer because of inability to do a job of servicing through lack of equipment.

Not a few garagemen in small towns, when they have obtained the services of an expert mechanic of whose abilities they are proud or when they purchase some machine to facilitate service and repair work—especially if none of their rivals has such a device—advertise the fact in good display in the newspapers.

When an agency for a new car, or tractor is taken, every live garageman will announce the fact as widely as he feels that he can afford to.

Ford dealers in small towns are particularly fortunate in having suitable advertising of a characteristic and distinctive type made up for them by the factory experts, or by their distributor, usually accentuating what a Ford passenger car or light truck can do for the purchaser's pleasure and business.

The truck dealers as well as the tractor men have been making somewhat of a specialty, of late, in going hard after the farm trade and factories and distributors generally are now planning advertising layouts with cuts for newspaper publicity, calculated to materially assist the small town garageman-dealer in "landing" this very

valuable kind of trade. The modern farmer with a good farm of 100 acres, or thereabouts, and upward, is usually a prospect for a passenger car—if he is “caught” in time—a motor truck or two; possibly a trailer and almost always at least one tractor. Even the small farmer whose agricultural efforts are limited to a truck garden, or one or two small fields nowadays, can be shown the wisdom of purchasing at least one of the smaller “one-man” tractors guided by hand, and many garagemen are beginning to take them in stock.

Not a few small town garage operators have learned the value of attracting commercial trade, and here and there are springing up purely commercial garages—that is, garages devoted to the storage and servicing of trucks and trailers only. In cities like Philadelphia, Chicago, New York and Detroit, a few real commercial garages are found, but even then, not in large number, the “mixed” type being, however, quite usual—meaning those that take both passenger and commercial cars.

Truck agents who conduct garages and garagemen who have taken on a truck agency as a side line are the logical ones to launch into the purely commercial garage business.

It is a fact, to be deplored, that there is much more poor advertising in the garage business, than good advertising; but that holds good for most lines of business in which advertising has not been developed to the point of an art. Some garagemen still seem to hold the moth-eaten idea that the name and address of the owner are the

main points to stress in a message of publicity; but such an advertisement, or one based alone on that idea is only a rudimentary form of publicity. There is nothing else to distinguish it from the advertising of any other house in the same line. The garageman must not only tell where he lives, but what he can do to reach the other fellow *where he lives*. He must tell what he can do, what his facilities are for doing it and how well he can do it, and he must reach the right parties who will be interested in knowing about it, and who are apt to act on its suggestions. That alone is real publicity for the business man.

The small town garageman should stick to the newspapers in the sense that he should never desert that particular field of publicity; but it doesn't mean he should never wander simultaneously with printer's ink into other fields. Some garagemen in small towns advertise successfully—in an auxiliary way—on safety match cases of the flat pasteboard, "vest pocket" type; on the pasteboard tops of milk bottles and on wrapping paper supplied to hardware and oil companies. This is an expensive form of publicity and it is a difficult matter to trace thereto any direct results. But it often helps, especially where the garageman is just starting in business. Theater programs are good mediums. Dodgers are seldom worth while, for the reason that they blow away before they reach their destination; they are ruined by rain and nine times out of ten the distributors of them are careless or unreliable. Of the many ways of "putting over the message" probably the dodger is the most useless.

Misleading, or badly expressed advertising, is worse than none at all—witness the case of a garage in a small town where the following placard appeared on a much battered 1911 model automobile:

“ONLY \$275.

“This Won’t Last Long.”

INTERESTING AND KEEPING EMPLOYEES

HARDLY any one would expect a domestic, nowadays, to remain in a household where there were virtually no modern conveniences; where the plumbing was old-fashioned, the kitchen range that of a bygone day, and the woodshed half a block away in the back yard. Yet some garage owners in small towns wonder why they can’t keep the smart young mechanics who can command high pay when the facilities about the place summed up represent little more than a bench, a vise or two, and a kit of indifferently assembled small tools in poor repair.

A garage is a modern place of business for modern vehicles, and if it is not run according to modern ideas from the start, one thing is positive—it won’t be running long. There used to be a saying that no business would “blow up” quicker than a restaurant that wasn’t run right, or that didn’t become popular in a short time; but all that’s changed. The garage that isn’t modern, that hasn’t the proper facilities, is slated

for quicker combustion than any business in the world.

That is because the foundation word of the garage is *Service*, and without a good equipment, real service is impossible.

In various lines of business, shiftless workmen with poor tools can "get by" for the first time, and perhaps for even the second; but not so in the case of the garage. The fury of the "woman scorned" is a mere scowl compared with the rage of the average car owner who has paid a round sum to have his automobile, or his truck, put in good condition, and then, when he starts to run the vehicle, finds out in a little while that he has been bluffed to a finish. It may be a poor workman who complains of his tools, but it's a fool workman who will work very long with tools that need complaining about.

A real workman, one worth keeping, expects to work and to give the best that is in him when he applies for a job, or is hired. It is very evident that he cannot do justice to himself, his job, his employer, or his employer's customer if he is not provided with the proper means of turning out good work. Some mechanics own a considerable number of the smaller tools with which they work and carry them about from job to job. But they cannot own much in the way of garage equipment, and it is up to the garage owner to supply his workmen with it.

Where light general repairs are done, the workman expects to find at least one good-sized work bench, having drawers that lock, compart-

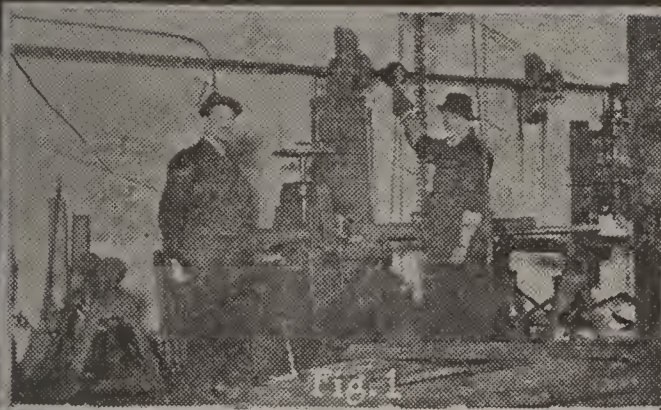


Fig. 1. Sometimes it is advisable to let the garage mechanic assist with the heavy repair work "farmed out" to a neighboring machine shop.

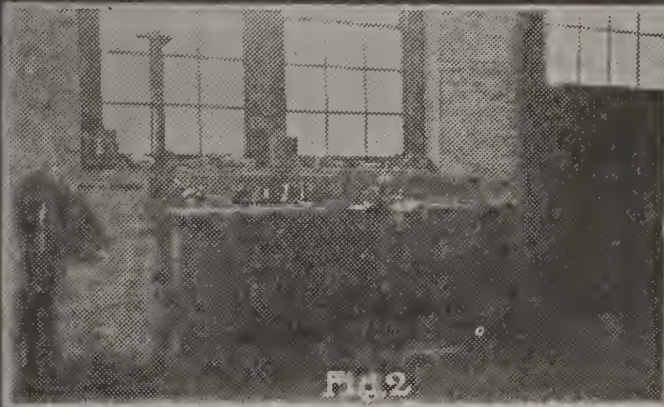


Fig. 2. A properly equipped workbench beneath a window helps to retain the health and interest of the employee.

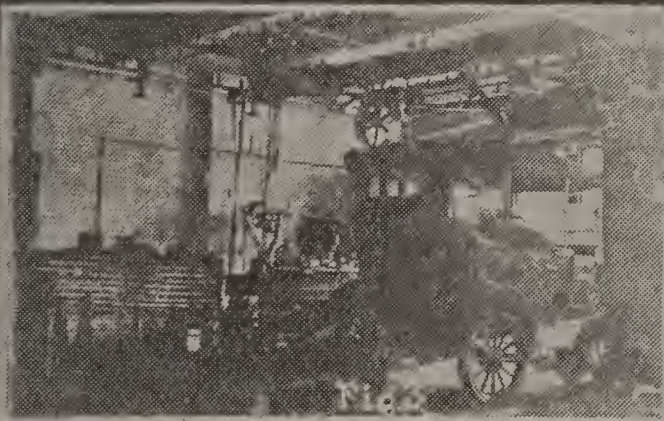


Fig. 3. This shows the corner of a well-equipped small town garage.



Fig. 4. Little dignities like a private desk and an office partitioned off, cater to the self-respect of the garage superintendent

ments for nuts, bolts and small parts, and a good vise or two; small bench tools, like files, reamers, scrapers, and wrenches; a motor stand; a portable electric drill; plenty of jacks; an auto "ambulance;" a chain hoist for raising heavy articles like motors and truck rears; a cleaning table with plugged bottom for draining; an emery wheel for grinding; an air compressor, and one or two wall racks for storing stocks and dies.

In short, there should be equipment so that the mechanics can overhaul motors, line wheels, tear down and assemble gears, adjust carburetors, transmissions, and the like. Many garages, even in quite small towns, make a practice of having "emergency" motors, transmission systems, and other parts already assembled, or "semi-assembled" for quick use for car owners while similar parts are being repaired in the garage. Often a nominal charge for rental is made while the owner's parts are being adjusted.

It is well for the garage owner or operator, to make an advantageous arrangement with an outside machine shop for taking care of the heavier repairs for which the garage is not equipped, and not infrequently the garage mechanic can assist at this "farmed out" work and help to expedite it.

The garage employe in the small town, like most other workmen in the less populous communities, is obliged to do a greater variety of jobs than a city workman, and this is all the more reason why he should have proper accommodations. The country garage employe spends

considerable time in removing and putting on tires. It's a hard and disagreeable job, and it can't be done with a button hook and a piece of tomato can; yet the facilities for doing the work are often not much better in the country garage. Every garageman who has been in business for any length of time knows what is the proper equipment for taking off and putting on tires and handling wheels expeditiously; knows that the job is arduous; knows that some truck wheels weigh as much as 1,500 pounds, and knows that he should provide for handling this class of work, if he is to keep an employe who has respect for his strength and his future.

But there are many other ways of interesting and keeping employes in the garage business besides providing them with the proper tools and equipment, though that, of course, is the first consideration.

Probably no country garageman—or city mechanic, either, for that matter—expects to be fussed over by an organized welfare department; but he has a right to expect a little humane consideration for his comfort. For instance, his workbench should be, if possible, placed beneath a window so that he can have advantage of the daylight as long as possible. He should have a cool and airy place to eat his lunch in the garage—so far as the place will permit—if he does not go out to meals in summer. He should also be kept warm in winter.

In the cities they generally take care of these things pretty well, but the country garageman

often has to work in the cold, or in a garage that in winter is heated only in spots.

Some garage owners are coming to see the necessity for keeping pace with the times in doing something to hold their organization together. It has come in about every other business under the sun, and the garage operator in the small town might just as well face it now, as it is bound to arrive.

In many small town garages in Pennsylvania and New Jersey, garage owners abreast of the times have provided tables, chairs, magazines, such as trade journals, and even checker boards for their mechanics and other workmen during the recreation hour.

Now and then one runs across a garage of two stories, where a portion of the second floor is given over to a billiard room for employes. This is still rare, but the chances are that within two or three years it will not be so uncommon. The personal equation has crept into business of late more than ever, and no longer is it permitted for an employer to regard his men as mere machines. He must take thought for touching them on their amusement side, to arouse interest and loyalty, if only from a mercenary motive. Otherwise he will soon find his competitor absorbing his business along with his organization.

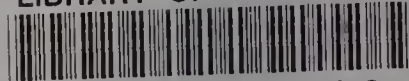
This is anything but a radical viewpoint—its trend is positively away from the creation of radicalism, which is fostered by the careless treatment accorded to employes. Is it better to

amuse the young employes about a garage—and nowadays most of them are young men—or to have them lounging about at lunch hour in front of the place, the more thoughtless of them, as they are apt to do in some small towns, passing audable remarks about every girl who goes by, thus making the garage a nuisance?

Another point that the employer should consider well in looking out for the interests of his men is the character of the "second in command." In garages, probably more than anywhere else—and it is often enough in business and industry—the "second in command" is the rock upon which many a promising organization has been wrecked, where that individual has been given too much "swing" without careful supervision.

Many a young mechanic has been heard to say: "I could get along fine if it wasn't for Mike, the assistant boss."

"Mike" is entirely too apt to be some quick-witted young chap who either by real ability, which is possible, or more often by ingratiating himself with his superiors, has been placed in direct charge of the garage, or one or more of its departments, if it is big enough to have them. He is apt to be a real expert in "passing the buck;" in ducking responsibility when an error is made; in posing as the inventor of helpful "stunts" which some one under him has worked out; in humiliating the man against whom he has a real or fancied grudge; in inventing alibis for himself, and in running to his "boss" and



tattling against and exaggerating everything said or done by the man he dislikes, that can be twisted into a detrimental report.

Every garage owner has met this chap—if not in his own place of business, then in a competitor's. "Mike" is the greatest little disorganizer in the small town garage business. He needs the "grand bounce," and the wise employer will waste no time in "laying him off" if he wishes to keep his organization and build up his trade.